Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "THE ELECTRICAL ENGINEER."

VOL. XXXIV. NEW YORK, SATURDAY, OCTOBER 28, 1899. No. 18.

PUBLISHED EVERY SATURDAY BY

ELECTRICAL WORLD AND ENGINEER

(INCORPORATED.)

120 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 4044 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

CHICAGO OFFICE, - - - - - - 936 Monadnock Block.

PHILADELPHIA OFFICE, - - - - - - - 929 Chestnut Street.

J. M. WAKEMAN, - - - - President and General Manager.

T. C. MARTIN AND W. D. WEAVER, - - - - - - - Editors.

T. R. TALTAVALL, - - - - - - - - - - Associate Editor.

CARL HERING, - - - - - - - - - - Special Contributor.

NOTICE TO ADVERTISERS.

Change in advertisements intended for a particular issue should reach the office of the ELECTRICAL WORLD AND ENGINEER on or before MONDAY morning of the week of issue. New advertisements can be received up to 10 A. M. of Tuesday of the week of issue.

The first issue of each month is an export issue, having an extraordinarily large foreign circulation in addition to the regular domestic and foreign circulation of this paper.

TERMS OF SUBSCRIPTION.

United States, Canada or Mexico . . . . . per year, $3.00

Foreign Countries within the Postal Union, ... 6.00

Single Copies, ...10

In requesting your address changed give OLD as well as new address.

(Entered as second-class mail matter at the New York Post Office.)

NEW YORK, SATURDAY, OCTOBER 28, 1899.

CONTENTS.

	Page.
Editorial	641
John Millard Roach	644
Annual Meeting of the Street Railway Accountants	644
The International Commercial Congress at Philadelphia	644
Woburn, Mass., New Central Station, by L. R. Wallis	645
New York Electrical Society	647
Mt. Whitney, Cal., Transmission Plant, by Donald H. Fry	648
Protection of Interior Wiring from High Potential Currents, by Warren B. Reed and Lyman C. Reed	649
A Multiple Lightning Flash, by A. E. Kennelly	651
Annual Meeting of the American Street Railway Association at Chicago	653
Current News and Notes	657
LETTERS TO THE EDITORS:	
Railway Motor Rating, by Cary T. Hutchinson	658
Professional Degrees, by C. F. Brackett, F. B. Crocker and Townsend Wolcott	659
Digest of Electrical Literature, compiled by Carl Hering	660
New Books	665
The Monarc Arc Lamp	665
New G. I. Push Button Switch	666
Exhibits at the Street Railway Convention, Chicago	667
DEPARTMENTS:	
Financial Intelligence	673
Commercial Intelligence	673
Special Correspondence	675
General News	677
Personal	679
Legal	679
Trade and Industrial Notes	679
Illustrated Record of Patents	679

THE STREET RAILWAY CONVENTION.

The annual meeting of the American Street Railway Association last week in Chicago was interesting and suggestive in many ways, as our report of the proceedings elsewhere in this issue will show, although, as usual, one needed to be present to get the full significance of the occasion and to learn the real drift of things. For example, when we recall what a stronghold of the street railway cable system Chicago was, not long ago, it was rather amusing to see the local officials dub the exhibit at Tattersall's in all their literature and posters the "Electrical Exposition." As a matter of fact, the poor cable was utterly unrecognized, and so far as we are aware not a single exhibit brought it to mind. Another note of progress was the extension of the privileges of membership to elevated railroad companies. It could not long be otherwise under the régime of electricity which is reducing all systems urban, cross-country, underground and long distance to common standards of method and operation, in all of which the electric surface street railways within the ranks of the Association have done such successful pioneer work.

While the papers and discussions were all excellent, we make bold to say that they were hardly representative of the fine body of men gathered together. In other words, there should be more papers at such an annual meeting, on more topics, with more participants in the controversies which elicit so many facts of value. Of course the exhibit, standing alone, was worth the while, but in view of the enormous expense of the annual convention better transactions must be had or the association will suffer. From first to last $75,000 or $100,000 must be the outlay for the convention, and the results are not fairly commensurate. The street railway field bristles with topics for discussion, it brims over with the talk of earnest, experienced men, and a little more effort would surely crystallize all this for the annual meeting which is still the great event of the year in the industry. To some extent, the meeting of the Accountants draws off the available talent and topics, but the diversion is after all slight. It is some compensation in view of the paucity of real work on the convention floor, to learn from the supply men that they never had a better convention for actual business on the spot, than that of last week, and the indications certainly justified their most optimistic statements.

One incidental point not much dwelt on in Chicago may have a good deal to do with the growth of this strong Association. We allude to the great concentration and consolidation of properties that has gone on during the last few years. Where companies existed we now have systems and syndicates, and the effect on the membership will have to be closely watched. It is said, for instance, that one consolidation representing some twenty-five roads, each of which would have been good for individual membership, was represented at Chicago by two officers. If this were to go on the Association would soon become a mere "Rump Parliament." But we do not think that such a fate impends. On the contrary, the larger the corporation the more men it is likely to send, with less tax on its resources, if they can learn something; while, per contra,

if the smaller roads are catered for liberally and judiciously, they, too, will fall in line. Besides there are other outlooks and onlooks. Just as it has taken in elevated roads, so, if it be alert and wise, the Association will bear in mind the automobile and not harp too insistently on either the "Street" or the "Railway." The Constitution of the United States has been found broad and big enough to cover nearby Cubans and remote Filipinos with its beneficence, and the American Street Railway Association not less has a policy of expansion to pursue, a policy both irresistible and inevitable.

Central Station Breakdowns in England.

One of our English contemporaries refers to a regular epidemic of interruption of electric lighting service in Great Britain during the present autumn, the text of its comment being a recent breakdown of the Hastings station. In this instance, it says, the irony of fate selected for the latest victim of a mysterious breakdown, an engineer who, but a few months ago, was awarded a premium by the Institution of Electrical Engineers for a paper on "The Prevention of Interruptions to Electricity Supply." Most of the interruptions in lighting service, it states, have been from apparent and easily avoidable causes, and several seem to have been due to failures of "improved" switchboard devices. We believe we are safe in saying that an interruption in electric lighting service is very rare in this country, and almost unheard of in our larger cities. What the fundamental cause of this difference may be it is difficult to say. Possibly it lies in the greater latitude which appears to be allowed central station engineers in Great Britain with respect to the introduction of their own ideas in the way of changes from standard practice. In this country security of service is the prime consideration, and the engineer, with the fear of the hard-hearted Board of Directors ever before him, hesitates long before becoming responsible for anything involving untried elements.

Railway Motor Rating.

Dr. Hutchinson's interesting letter on this subject, appearing in our Letter column, clearly sets forth the proposition upon which Mr. Lundie's suggestion, of last week's issue, appeared to have been based. The proposition is that it is desirable to rate constant-potential intermittent-service motors upon the average input that will ultimately bring about their limiting temperature elevation, on the specific numerical basis of one hundred times the steadily sustained current strength in amperes that would cause that temperature elevation to be reached. On this basis a 500-volt railway motor which reached its temperature limit under a steady current of 60 amperes, would be called a 6000-motor, on the assumption that the same temperature elevation would be brought about by 120 amperes 50 per cent. of the time; or by 240 amperes 25 per cent. of the time, up to a certain limit, of say 250 amperes established by the conditions of commutation or sparking at the commutator.

It will no doubt he admitted by all that the assumption is not strictly true. It can, at best, be only roughly correct as an empirical rule within certain limits. In order that the assumption should be true, it would be necessary for the energy losses in the motor to bear a constant proportion to the intake or output, within the commutation limit; or, otherwise stated, that the efficiency of the motor, neglecting mechanical frictions, should be constant at all loads within the commutation limit. It would also be necessary that when temporary overloads are applied, say 240 amperes for one-quarter of the time, that the final temperature should be the same whether the overload occurred in the first quarter, or in the last quarter.

The first cannot be true; because the copper losses are approximately proportional to the square of the input, while the iron losses, although very complex, are roughly constant, and the sum of a constant and a square function cannot be a first-power function. The second cannot be true, because the cooling is different in the two cases, and the final temperature would necessarily depend not only on the average input, but also upon the history of the input. These were our editorially expressed objections last week to Mr. Lundie's proposal.

Dr. Hutchinson takes the position, however, as we understand it, that although the assumption is not strictly true, it is sufficiently nearly true in actual railway motors to form the basis of a convenient rating. Leaving the question of irregular cooling out of consideration, there is undoubtedly some force in this contention. We find that a number of railway motor test sheets show that, neglecting friction, the efficiency of the motor is nearly constant over a considerable range. On the other hand, however, we find that the deviation from constant efficiency is considerable in some types of railway motors on the market; and moreover, that in certain types of intermittent-service motors, such as crane and elevator motors, the deviation is marked. There must be considered, moreover, the complexity due to altered conditions of operation, as in shunted or commuted field coils.

We think, therefore, that while the advantages of the proposal are not to be gainsaid, yet the uncertainty of the fundamental assumption is too great to warrant its adoption. If Mr. Lundie and Dr. Hutchinson can establish their assumption upon facts and tests within the necessary degree of commercial accuracy, we shall be glad to revoke our opinion and submit to the demonstration. Meanwhile, if a motor were guaranteed upon the proposed basis, and it was required to determine whether the motor filled the guarantee, it would be necessary to test it under not only its continuous full load, but also under at least two or three temporary overloads, which would be a comparatively lengthy and elaborate process; whereas, under the customary method of rating such motors, one test under one load suffices.

Overload Cut-Off Devices for Flat-Rate Consumers.

Although the connection of consumers to central station systems on the flat-rate basis has to a large extent gone out of fashion and is not considered an economical or commendable practice, there remain many cases where the cost of a meter and the trouble incident upon reading it constitute a considerable addition to the cost of service. Particularly is this the case in small towns, where the other costs of connecting an installation are small, the wiring being overhead and of a simple character, and where on account of the absence of gas many modest residences would use from 25c. to $1 worth of current per month, could a central station afford to supply such small demands. A similar case arises also in large cities where current is distributed to many offices or apartments in one building, each tenant using but a small amount of current, but requiring a meter just as expensive as though the current consumption were one hundred times as great. A particularly aggravating case of meter expense is that where the other costs of furnishing electricity are unusually low, as in the case of some water power plants. Such a case is that of the Mt. Whitney transmission plant, described on another page of this paper, where flat-rate consumers are connected and the supply company is protected by means of an ingenious interrupting cut-out or make-and-break device.

The simplest, cheapest and most generally used protection to prevent the consumer from exceeding the current consumption for which he pays is a fuse, but its use is subject to great disadvantages. If the consumer is not permitted to replace the fuse in case it

burns out, he is left in darkness until he can obtain assistance from the central station. If permitted to replace the fuse, he generally proceeds to do so with a piece of copper wire, effectively preventing its operation thereafter. A circuit breaker is somewhat preferable, as it is more accurate and is more readily restored. In the small and inexpensive forms now made it would be well adapted for this service were it not so easily fastened to prevent it from operating. The breaker might be made after the manner of the "pop" safety valve so that it could not be tampered with, but no such instrument is now on the market. Either a fuse or a circuit breaker as ordinarily used leaves the consumer's premises in darkness when it operates, which is no small annoyance. The contacts of the instrument might be shunted so that when opened the lamps would still burn dimly, sufficient at least to permit the consumer to find his way to the instrument to restore it, but not sufficient to give him satisfactory lighting.

A device described in the article above referred to accomplishes this result by causing the lights to wink or flash in such a way as to render their light too disagreeable for continued use, but still illuminating the premises. The chief advantage of the arrangement is that its interruptions cease as soon as the overload is removed, so that the consumer does not have to visit or tamper with the protecting device. The chief disadvanage seems to be that its contacts must be eventually burned away by repeated working, especially if the number of lights connected is large. It would appear to be possible to devise a circuit breaker which would, in case of an overload, insert in series with the circuit a resistance sufficient to materially dim the lamps, but when the overload is removed will immediately restore the normal condition. Such a breaker, if protected from tampering, would appear to combine all the advantages of the various devices mentioned above.

Multiple Lightning Flashes.

We print this week a half-tone copy of a photographic glass negative picture of a remarkable lightning flash that appeared some weeks ago in the neighborhood of Philadelphia. There is a popular impression that lightning never strikes twice in the same place. As a general proposition we believe this to be entirely unreliable, and in this particular case the lightning seems to have struck no less than fourteen times in rapid succession very near the same place. These multiple flashes are quite rare, but they are occasionally witnessed. We doubt, however, if any photograph has ever before been reproduced with so beautiful a ribbon of parallel streamers. The most remarkable fact is that all of these fourteen streamers can be traced separately from their first discernible position in the cloud down to within a short distance of the base near the horizon, and that all the ripples in any one streamer are to be traced, with practically faithful reduplication, in the neighboring parallel streamers. Unfortunately, it is impossible to reproduce all the fine details of the negative in the half-tone, and, consequently, many of the fine properties of the ribbon, as appearing on the photographic negative, are lost to view on the printed page.

According to the explanation which is offered in the description accompanying the print, it would seem that the angle which the ripples in the band make with the horizon, serves as an indication of the ratio between the vertical and horizontal components of the velocity of the air, at the position of the flash, during the time of its duration. Since the angle made by the ripples with the horizon seems to be about 18°, of which the tangent is 0.325, it would appear that the vertical component was 32.5 per cent. of the horizontal component; or, that the wind had an up and down component approximately one-third of its horizontal component. If the theory advanced in the description is correct, and it seems very plausible, it is evident that photographic records of such multiple flashes become of value in the study of the aerial motion in the vortex of a thunder storm. We trust that many of our readers may be stimulated by this example to expose their cameras to the stormy skies of nocturnal thunder storms.

The different kinds of lightning which occur may be classified as follows: (1) Single flashes, either between earth and sky or between neighboring clouds. (2) Bifurcating or dividing flashes, where a discharge starts as a single flash and divides into two or more branches. (3) Multiple or ribbon flashes, of which the case above considered is an example. (4) Sheet lightning, which is the reflection from cloud surfaces of flashes of lightning not directly visible. (5) Heat lightning, which is the illumination of clouds from internal discharges. (6) Bead lightning. (7) Globular lightning. (8) Dark lightning. Bead lightning has been described as a succession of bright beads, apparently strung in midair upon the path of the discharge and either attending or following the flash which establishes them. Globular lightning is that peculiar form which has been so often described as perambulating the surface of the ground and finally bursting with loud sound. No photographs of this phenomenon have, we believe, ever been produced, and the phenomenon itself has been held up to doubt and ridicule. It would seem, however, that many observers have independently testified to witnessing it. As for dark lightning, it seems to resemble flash lightning, except in regard to the color of its trace on the photographic plate. In the photographic negative from which the ribbon flash above mentioned has been reproduced, there are faint, but distinct, flashes of dark lightning visible, as though they were composed of opaque streamers illumined by the bright flash or ribbon and therefore leaving shadows upon the sensitive film. They seem to have no connection with the ribbon flash, either in form, location or proximity. It has been suggested that dark lightning is due to a reversal of the photographic image, but these streamers are comparatively so faint that it is difficult to believe that they have been sufficiently bright to produce such reversal. We think it is necessary to suspend judgment upon a phenomenon that is already in midair.

The systematic study of lightning and its ways becomes of continuously increasing importance, in view of the multiplying opportunities which overhead conductors offer to disturbance, if not to destruction, by lightning. Every pole which rears its crossarms above the landscape is, in one sense, but another target offered to the thunder-bolts of Jove. Moreover, the increasing electric pressures which are coming into use for long-distance transmission, have striking distances between needle points of several inches, and are lightning in miniature, so that it becomes more and more difficult to discriminate in a lightning arrester between the miniature artificial lightning which is useful, and the inductive disturbances due to real lightning, which may be baneful. The aggregate of the annual amount of damage done to wires, poles, conductors, terminal apparatus, transformers and armatures by lightning is quite serious, and systematic study of lightning ought to be capable of reducing this tax yearly levied by the Storm King.

We think that a word of suggestion should be offered to lightning-photographers. It requires time, care and opportunity to produce a good photograph of lightning and such photographs are sometimes to be found that immediately excite unsatisfied curiosity and arouse repelled interest. The photographer sometimes seems to think that his photograph terminates his work. The fact is, however, that the careful observer's work is only started by means of the photograph, and full particulars of times, distances and other physical phenomena should be immediately collected and associated with the photographic record. By this means the picture may be changed from a mere casual observance to a valuable permanent scientific record.

John Millard Roach.

JOHN M. ROACH.

John Millard Roach, the newly elected president of the American Street Railway Association, was born in Noble County, Jackson Township, Ohio, on Jan. 30, 1851. His ancestors came from Virginia and settled in the garrison on the Muskingum River, near Beverly. Mr. Roach left Ohio, when 11 years of age, and went to Rockford, Ill., where he attended a high school for one year. He then went to Corinne, Utah, and from that place to Helena, Mont., covering the entire range of the Rocky Mountains and spending three years in that section of the country, prospecting for gold. On a "bucking cayuse" he rode to Walla Walla, Washington Territory; Portland, Ore.; Oakland, and down in the lower part of California, around White Pigeon, Utah, and back into Helena, Mont.

After roving around the Western part of the continent, making and losing large sums of money, he returned to Rockford for a year, and settled in the City of Chicago on Oct. 7, 1872, entering the employ of the North Chicago Street Railroad Company as a conductor. He was an absolute stranger in the city, and had no friends nor acquaintances there. After serving the company as a conductor for four months, he was taken into the office and made cashier. From that position he served in all the intermediate positions, until in 1889 he was made general manager of the North Chicago Street Railroad Company, and in 1897, general manager of the West Chicago Street Railway Company. In both of which positions he remains in the companies which have succeeded to the control of these properties.

Mr. Roach married Katie E. Lyon, in 1872, at Rockford, Ill., and has one son, F. Lyon Roach, born in 1875. Mr. Roach is a member of the Union League Club, Marquette Club and Union Club, of Chicago, and a Knight Templar, Lincoln Park Commandery.

Annual Meeting of the Street Railway Accountants.

During the meeting of the American Street Railway Association in Chicago, last week, the annual meeting of the Street Railway Accountants' Association of America, was also held, under the chairmanship of President Calderwood, who, in his address, said: "While our association has accomplished much by the practical establishment of a permanent classification of accounts, we are far from having concluded the work necessary for a complete system of accounting, such as would be available for purposes of comparison. What we now need and must have before we shall have fulfilled our mission, is the establishment of a unit of comparison. We may have properly classified the cost of maintenance of way, transportation and general expense, and severally and collectively determined the amounts of each for a certain period as compared with another similar period; the comparison of the totals of one period with another may be in the aggregate more or less. This means nothing in itself, unless we can reduce these several sums to a unit of comparison. Now, whether this unit shall be the ratio which each item of expense shall bear to the total revenue, or whether it shall be so much per car-mile, per motor-mile, per motor-hour or ton-mile, is the next great and important question for the association to consider and to settle. I would recommend the appointment of a committee on the Establishment of a Unit of Comparison. When this is done I shall feel that we are nearing our goal. With the classification and the unit established, the next important feature is a statement blank that will enable the accountants to present, in a uniform, simple and concise manner, the various results and comparisons."

The unit of comparison formed the topic of much discussion, and Mr. H. C. Mackey presented a paper on the subject. A very interesting report on blanks and forms was also presented by Mr. W. B. Brockway, of Toledo. The discussion on the unit of comparison centred chiefly around the car-mile basis, and the value of the car-hour as a standard. At the close of the meeting the following officers were elected: President, C. N. Duffy, auditor, Chicago City Railway Company; first vice-president, W. F. Ham, auditor, Brooklyn Rapid Transit Company; second vice-president, W. G. Ross, comptroller, Montreal Street Railway, Montreal, P. Q.; third vice-president, Elmer M. White, cashier, Hartford Street Railway Company, Hartford, Conn.; secretary and treasurer, W. B. Brockway, secretary and treasurer, Toledo, Bowling Green & Fremont Railway, Toledo Ohio; executive committee, J. F. Calderwood, chairman; C. L. Wight and C. K. Durbin.

The International Commercial Congress at Philadelphia.

The meetings of the International Commercial Congress at the Export Exposition in Philadelphia were continued last week. Two interesting subjects discussed were commercial education and the parcels post. President Seth Low, of Columbia University, was the chairman of the educational session.

William C. Barker, of New York, delivered an address in which the business methods which exist in Europe and America to-day were brought into very sharp contrast. In the opening part of his address Mr. Barker dwelt upon the fact that very much more attention is paid to the proper educational equipment of commercial travelers in Europe than in the United States. Schools have been established in many European countries where young men who intend to adopt a commercial career are instructed in international law, commercial law, treaties and the tariffs of different countries, as well as in modern languages. It is almost impossible to overestimate the advantages of such institutions. The speaker deplored the fact that so little attention is paid to such matters in America, where he declared "young men devote more attention to athletics than to international law and the commercial languages." The American commercial traveler, said Mr. Barker, who does not know the language and customs of the people among whom he is trying to sell agricultural machinery, for instance, is at a marked disadvantage with the man who understands both, even though the latter is the American's inferior in presenting the good points of his goods and in his appreciation of their possibilities.

The methods of the European and American manufacturer, continued the speaker, are very strongly at variance. The former considers time of no value, and, in consequence, sacrifices time to save outlay in new and improved methods, employs old tools and machines and speeds them to suit the manufacture of poorly paid workmen. The latter believes time is money, and in this belief he employs the latest and most improved machines and implements; speeds his machines to turn out the greatest possible amount of work, and employs the best men money can secure to operate them.

Chairman Low, in introducing President Eliot, remarked that universities have two functions. One is to discover natural laws, to discover the principles underlying invention, and the other is the teaching function. The university, while it is two or three steps removed from the application of the principle, is, nevertheless, vitally involved in the subject before the Congress.

To meet the objection that business training can best be gained in an office, President Eliot said he believed commerce and industry in their higher ranges to be eminently intellectual pursuits, and he knows of no other intellectual calling for which a professional school is not now provided. "New methods of preparing young men for these occupations," he said, in conclusion, "must be invented with discriminating foresight, established with prudence and maintained with liberality."

The afternoon session was presided over by Dr. W. P. Wilson. The subject for discussion was the "Parcels Post." E. S. Jackson, of Philadelphia, was the first speaker. He described the system which England had devised to advance her trade all over the world, and by which her merchants were kept in touch with the traders in the colonies. The Germans had not been slow to copy this British device and had been very astute in following the example. It was evident that the manufacturers and merchants of the United States must be permitted to export by means of parcels post if they are to compete with those great manufacturing nations. He thought the time had arrived to make this blessing international, and urged the foreign delegates to unite in urging their respective governments to organize such a post.

Woburn, Mass., New Central Station.

By L. R. Wallis.

THE Woburn Light, Heat & Power Company, of Woburn, Mass., has recently completed the construction of a new and distinctly modern combined lighting and power plant in the City of Woburn, a suburb of Boston, located 11 miles out and reached by the Southern Division of the Boston & Maine Railroad. Its territory consists of the City of Woburn and the adjacent towns of Winchester and Stoneham, comprising a combined population of nearly 30,000 people, and covering over 100 miles of streets. The street, residence and store lighting of the above mentioned places is supplied exclusively by the company, which also furnishes power for a portion of the Lynn & Boston Railroad system and the North Woburn street railway, as well as for various manufacturing interests located in its territory.

Previous to the building of the new station the company operated the old belted station formerly owned by the Woburn Electric Light Company, which was built in 1888 and had steadily deteriorated until it was in a most dilapidated condition; its condition and high cost to operate making a new station a necessity. This old plant was located almost in the centre of the city, where a water supply was unavailable and side track facilities an impossibility. For these reasons a relocation of the plant became advisable and a new site was selected which is most admirably situated from point of distribution, being centrally located in the territory which the company serves, while there is water for condensing and boiler purposes in abundance and accessibility to the railroad.

The main building is 100 by 123 feet long and 35 feet high, one-half of which is practically a two-story building, there being a basement under the engine room floor 10 feet high. Its construction consists of a steel frame with brick walls built around the same, with fire walls of steel and brick dividing the boiler from the engine room, and also the offices, which are located in the front end of the building, from the boiler room. The accompanying plan (Fig. 5), shows the general layout. The top finish of the walls presents a straight line, the roof being slightly pitched and some two feet below the line of the wall, thus giving it an architectural finish (Fig. 2).

While not in the strictest sense a fireproof building, much attention has been given to eliminate the possibility of a large fire loss. The floor beams are of heavy steel construction, and the floor consists of 3-inch matched spruce plank with a top floor of 1-inch maple The roof is of 2-inch plank with a composition tar and gravel covering, and the water is carried away through the inside of the building. Georgia pine monitors run the entire length of both the engine and boiler rooms, lighting and ventilation thus being obtained from overhead as well as from the windows in the walls of the building.

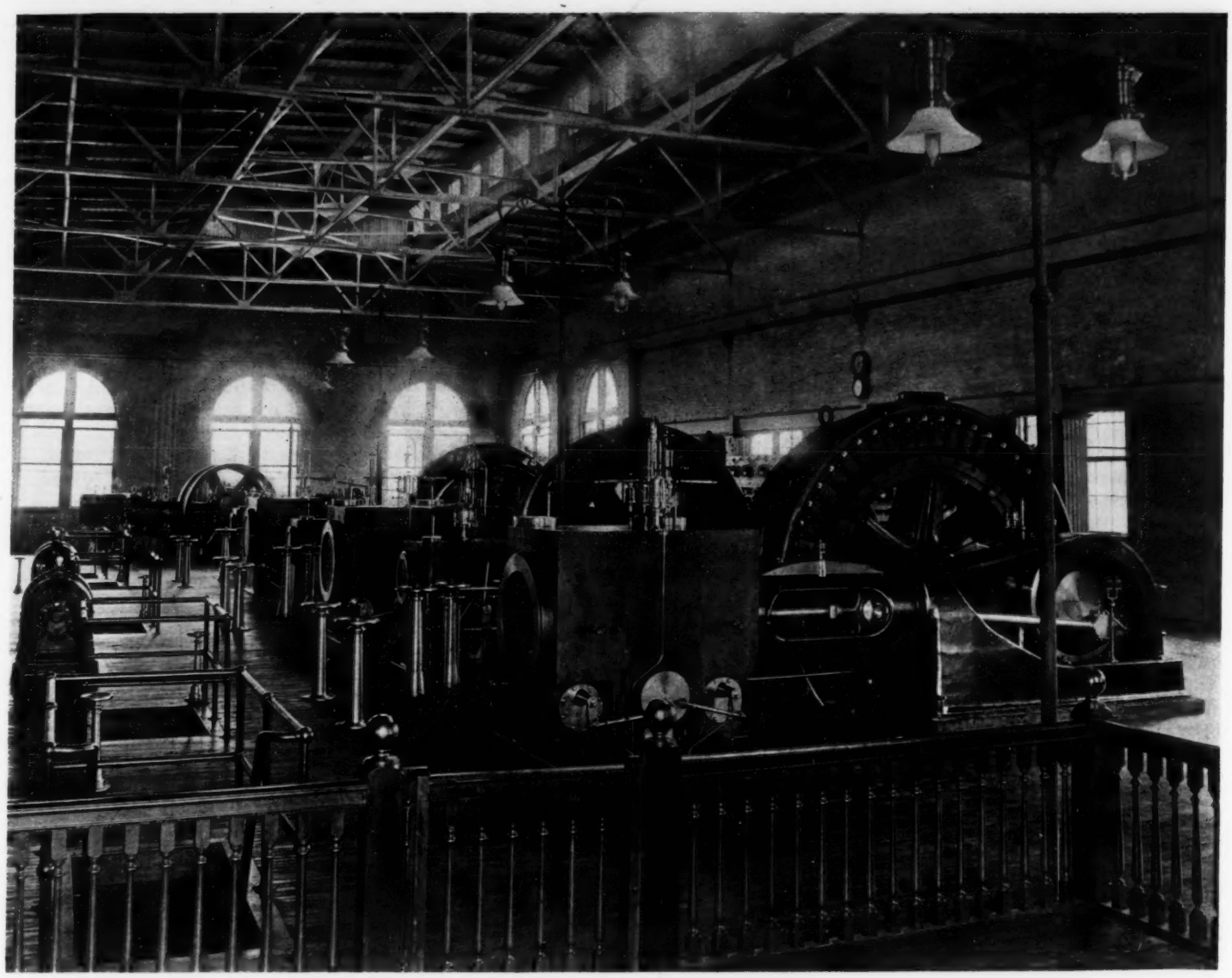


Fig. 1.—Engine and Dynamo Room.

The offices, which accommodate a general bookkeeping department, directors', manager's, electrician's and chief engineer's rooms, are commodious and conveniently arranged. They are located in the second story of the boiler room side of the building, and are upon arches built of steel girders, brick and cement, thus making them effectually fireproof from underneath. Toilet rooms for the executive force, a bath room and lavatory for the employees, repair shop, oil room, meter and lamp-testing rooms, are also located in this section of the building on the first floor directly under the offices.

The engine and dynamo room (Fig. 1) is 41 feet wide by 123 feet long, with a bay 9 feet wide by 63 feet long for the switch-

board and wiring and outlet of the feeder circuits. A six-ton hand traveling crane reaching any point in the room is installed, and is capable of handling any piece of the apparatus with which the plant is equipped. Sufficient room is reserved for an additional

FIG. 2.—WOBURN CENTRAL STATION.

unit, and the space for the belted unit, elsewhere mentioned, is ample to replace it with a direct connected set whenever the exigencies of the business requires it.

The engine room is very prettily lighted from tasty fixtures supported from the floor wired from underneath. Arc lamps are used, those on one side of the fixture being supplied from the 500-volt generators, five in series, and on the other side from the alternating current units, thus insuring light when any one of the units is in operation. The new engines installed are three Slater cross-compound condensing, running at 150 r. p. m., and developing 400 nominal horse power each. They are direct connected to three 300-kw Westinghouse generators, two of which are of the two-phase type and generating 2300 volts alternating current at 60 cycles. They are used for both lightning and power purposes. The excitation for the alternators is supplied by two direct-connected separate units, either one being capable of supplying both generators; one exciter is driven by a 500-volt motor supplied from the railway generator, and the other by a 220-volt two-phase induction motor supplied from the alternator after it has been built up from the 500-volt set. The arrangement of the various machines is clearly shown in Fig. 1.

The third generator is a 500-volt multipolar direct-current machine, and is used for supplying street railway power as well as for small commercial power customers. For this latter service two 90-kw generators which were used in the old station are utilized. One is connected to run a motor driven from the railway generator,and flexibly coupled to the second, which runs as a generator so as to supply power from an insulated circuit in order to comply with the insurance requirements. One engine, a 250-hp Erie Ball was brought from the old station and is belted to two 100-kw 500-volt General Electric generators, also brought from the old station and as an auxiliary to the main railway set.

The switchboard (Fig. 4), is of white Italian marble 2 inches thick, and supported by a steel frame. It consists of 14 panels supplied with Westinghouse appliances, including plunger-type switches for the high potential work, and wattmeters for measuring the output of the various generators. The board is wired for running the alternators in multiple, and they are regularly run in this manner, although the load does not require the continual operation of both machines. While two-phase currents are generated, they are distributed over the original system of wiring, which is single phase, and no attempt is made to balance the load on the separate phases other than by putting in the same number of series arc transformers on each leg.

The street lighting, which consists of arc lamps and series incandescent lamps intermingled upon series circuits, is supplied direct from the alternators through the medium of the constant current transformer system which has recently been brought out by the General Electric Company, and described in the ELECTRICAL WORLD AND ENGINEER of April 1, in connection with the Hartford, Conn., installation. The Woburn plant is, we believe, the first that has its entire lighting system from one style of machinery.

The street lighting service was formerly supplied with 1200 and 2000-cp series open arc lamps, which have all been changed to series enclosed alternating arc lamps operating at 6.6 amperes with from 70 to 73 volts across the arc. It may be added that the new system is doing much more effective illuminating than was obtained from the old open arc lamps.

The boiler room is 70 feet long by 45 feet wide and 35 feet high. In front of the boilers is located the coal pockets, which are a part of the main building and connected with the boiler room by arched openings and with the railroad by trestle, upon which the cars are elevated and emptied directly into the storage bins. No automatic coal handling devices are employed because of the comparatively small amount of fuel required to be handled per diem, but the conditions have been carefully studied with a view to reducing the labor expense to a minimum.

The boilers already installed are three of the Heine Safety Boiler Company's manufacture. They are 10 tubes high and 16 tubes wide, with a total of 155 3½-inch tubes 16 feet long. They are of

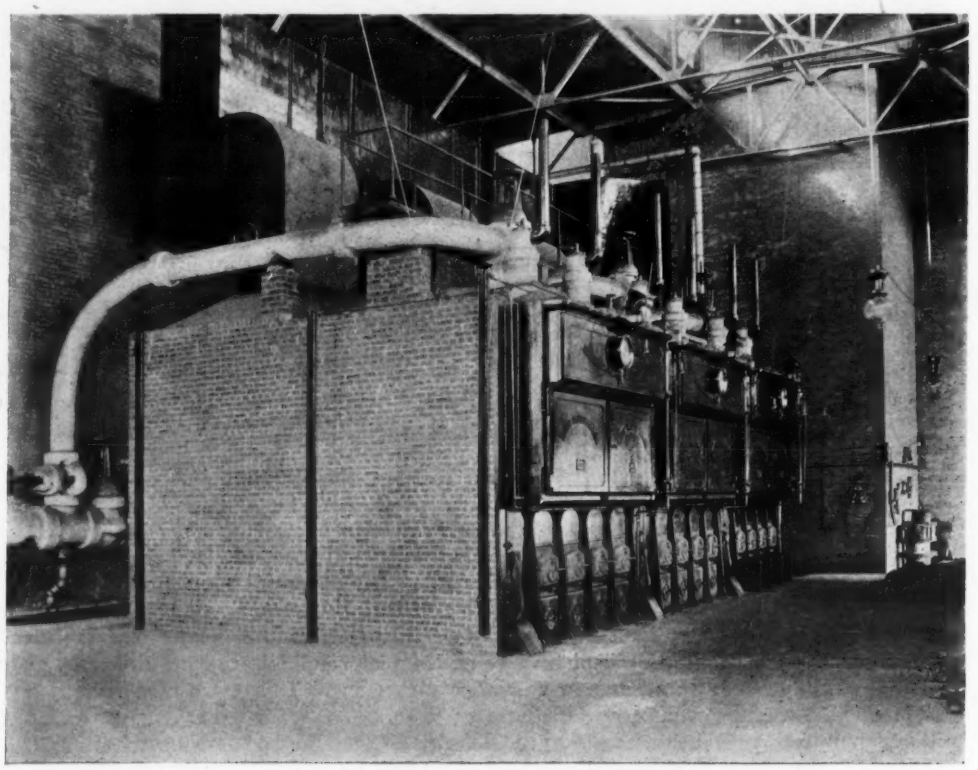


FIG. 3.—BOILER ROOM.

300-hp each at manufacturers rating, and are built to operate at 150 lbs., but are regularly run at 120 lbs. Hand shaking grates are installed in all furnaces.

At one end of the boiler room stands a brick chimney 140 feet

in height and 6 feet 6 inches internal diameter. A steel flue connects the boilers with the chimney, which is by-passed around an economizer with dampers so placed that the plant can be operated with or without the economizer as desired. Between the base of the stack and the wall dividing the boiler and engine rooms is located a 200-tube Green economizer supported upon brick arches elevated some 12 feet upon steel columns. The moving mechanism for scraping the economizer tubes is driven by a 104-volt alternating Wagner single-phase self-starting motor. Directly under the economizer are the Warren feed water pumps, which are in duplicate; a 1500-hp auxiliary feed water heater, and the Holly apparatus for returning the live steam drips to the boilers.

All of the steam piping is extra heavy and bends are used wherever practical. The boilers are piped to a steam header located to the rear and three feet from the boiler room floor. The engine supply is taken from the header through a Stratton receiver-separator, one to each engine, to the high pressure cylinder. Between the high and low pressure cylinders of each engine is installed a reheating receiver which is connected with the necessary traps for carrying away the condensation. For each engine a 300-hp primary feed water heater of the Whitlock type is installed horizontally upon steel brackets set in the foundations. Each engine is also served by an independent condenser of the double-cylinder, walking-beam pattern, furnished by the Warren Steam Pump Company. The exhausts from the condensers and pumps are connected with the 1500-hp auxiliary feed water heater, and the condensers are also piped to run condensing if desired. With this heater system the feed water is raised to 210° F., which the economizer increases to 250°. All of the piping, heaters, separators, condensers, constant current transformers, and wiring are located in the basement under the engine room floor. The high pressure piping is covered with magneso-asbestos sectional covering and magnesia cork cement.

In the fireproof oil room are two large steel storage oil tanks, one of which is used as a settling tank for the oil after passing through the filter. There are also two high pressure supply tanks, one containing cylinder and the other engine oil. These are connected with the storage tanks, with the condensers and also with the city water pressure. By a manipulation of the valves, the condenser draws a quantity of oil from the storage tanks into the supply tanks, from which the oil is forced up into the engine room by water pressure and is drawn from faucets as needed. The bearings and beds of the engines are piped to the filter, which is also located in the oil room, to which the oil, after running through the bearings, finds its way by gravity.

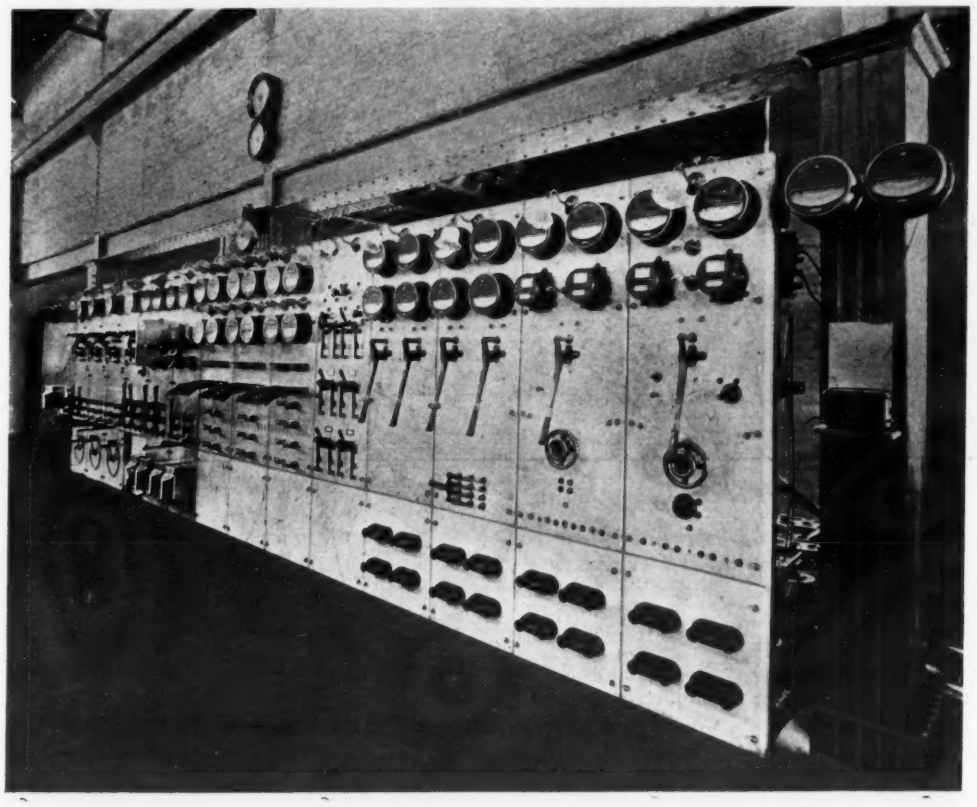


FIG. 4.—SWITCHBOARD.

The officers of the Woburn Company are William B. Littlefield, president; George H. Plummer, vice-president; Louis R. Wallis, treasurer and Manager. These, together with John F. Hay and E. M. Bancroft, comprise the board of directors. The company is capitalized at $175,000 and bonded for a like amount.

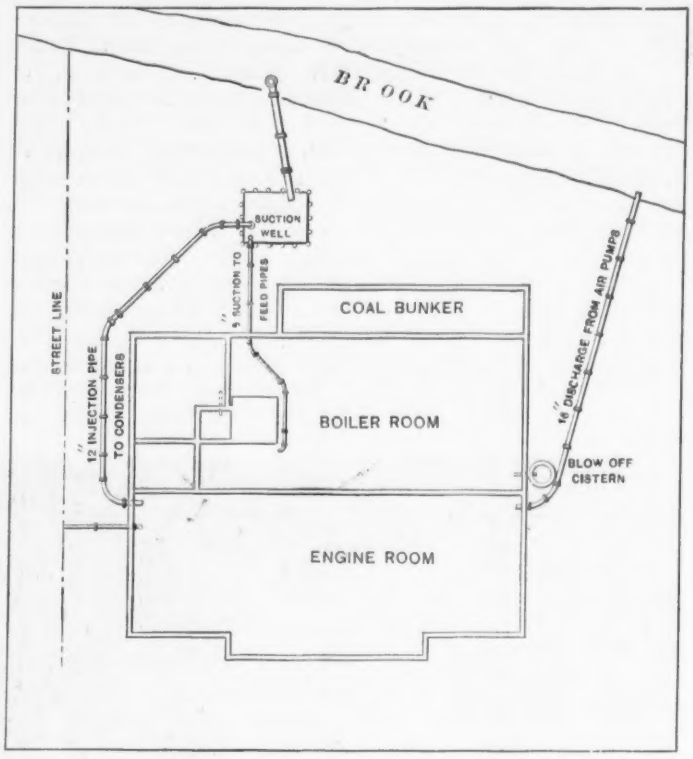


FIG. 5.—GENERAL LAYOUT OF PLANT.

The firm of Sheaff & Jaastad, engineers, of Boston, supervised the entire construction of the plant, and much credit is due them for the careful manner in which the installation is laid out and the economical results which obtain from its practical operation. A fuel consumption, averaging less than five pounds of coal per kw., has been obtained during the six months the plant has been in operation.

New York Electrical Society.

Preparations are now being made for the winter meetings of this popular and useful organization, which never before has had so large a membership and which has been built up to its present position solely by hard and intelligent work. In order that the able and self-sacrificing secretary, Mr. George Heli Guy, may be relieved of some of the burdens he has borne with such brilliant success, special committees have been formed this season, each of which is to take charge of work looking to a further development of the society's interest. These committees are formed from the society's council and are such as to promise that even the record of the past may be eclipsed. The committee on papers and meetings will consist of Dr. C. A. Doremus and S. L. Coles; on membership, F. A. Pattison and H. V. Henshaw; finance, C. Blizard and Arthur Williams. The society having by its recent rapid expansion outgrown its old constitution, a committee on constitution and by-laws has been formed, composed of F. A. Pattison, A. Williams and H. A. Sinclair. All these committees will get to work at once.

Mt. Whitney, Cal., Transmission Plant.

By Donald H. Fry.

THE latest of California's long-distance transmission plants—that of the Mt. Whitney Power Company, situated in Tulare County—while resembling other hydraulic electric plants of the Pacific coast in many respects, embodies several new features of interest.

The water is taken from the east fork of the Kaweah River, at an elevation of 2500 feet above sea level. It is rarely one finds a plant where nature has seemingly so forced direct advantages upon the adapting engineer, as at these head works. A natural granite dam from 3 to 30 feet long and 17 feet high forms a substantial head works. Through the large rock on the south side of this dam, a tunnel was drifted 6 feet high, 4 feet wide and 40 feet long, tapping the pool about 25 feet above the dam and 3 feet below its level. A screen made of 60-pound railroad iron protects the mouth of the tunnel from driftwood or whatever else may come down with the winter freshets. Fifteen feet from the outlet, the walls are timbered and boarded, the space between the timbers and the granite walls being grouted with concrete. In this way starts the wooden flume, which conducts the water direct to the head of the pipe line. It is absolutely safe from washouts, being well above all freshet marks, and yet the last drop that flows down the river can be caught in the flume. There is no need of storing water here, for the lowest mark the river has yet reached gives a flow far in excess of the maximum that the Mt. Whitney plant will need.

The flume itself is 30,000 feet in length, and but three feet wide and two feet deep. It has a fall of one foot in 200. The steepness of the mountain sides and the ruggedness of the country over which it runs made the construction of the flume, comparatively small though it be, quite a difficult undertaking. A great many trestles were required to bridge canyons and ravines, and even along the mountain side trestle work was necessary. Sand boxes and waste gates have been placed at intervals along the flume, and at the end of the flume is a large sand box and an overflow gate, at right angles to which is an apron nine feet wide, leading to the penstock. This apron is fitted with necessary gates and screens.

The pipe line is 3300 feet long, and in that length has a fall of 1325 feet. The first joint is a funnel mouth 50 feet long; where it fits into the penstock it is 50 inches in diameter, tapering to 24 inches. From this point down for 2140 feet, the pipe is of riveted steel, gradually reducing to 20 inches. The lower 1160 feet is lap-welded steel, 19 inches inside diameter at the discharge end. The joints of the lap-welded pipe are not the usual bolted flange joint. Instead, one end of each length is belled and the two joined together by riveting. This joint has proved to be most satisfactory, and much credit is due to the Lacy Manufacturing Company, of Los Angeles, Cal., by whom the riveted pipe was made, and the whole of the pipe line was laid.

The frange for the pipe was cut through solid rock nearly the whole length in one place, a cut of 20 feet having to be made. The last 400 feet at the power house was embodied in concrete, but above that the pipe was only anchored to the rocks at intervals by 1⅛-inch steel rods with turn buckles fastened to the pipe with steel bands, and held in place by cement collars. In the length of the pipe line there are six air valves, but a departure from the beaten path has been made in that there is no air chamber at the lower end. As regulation is gained by deflective hoods, and as it is a physical impossibility to shut even one gate within one minute, it is practically impossible to subject the line to any appreciable ram. Should a block of wood get into the pipe (the water passes through three sets of screens at the penstock), and block one of the three nozzles, the factor of safety is such there need be no fear of rupture from water ram. Moreover, the interior structure of the goose-neck or cast-steel reducing pieces, which take the water from the main line to the wheels, is such that it is impossible to completely block even one nozzle instantaneously.

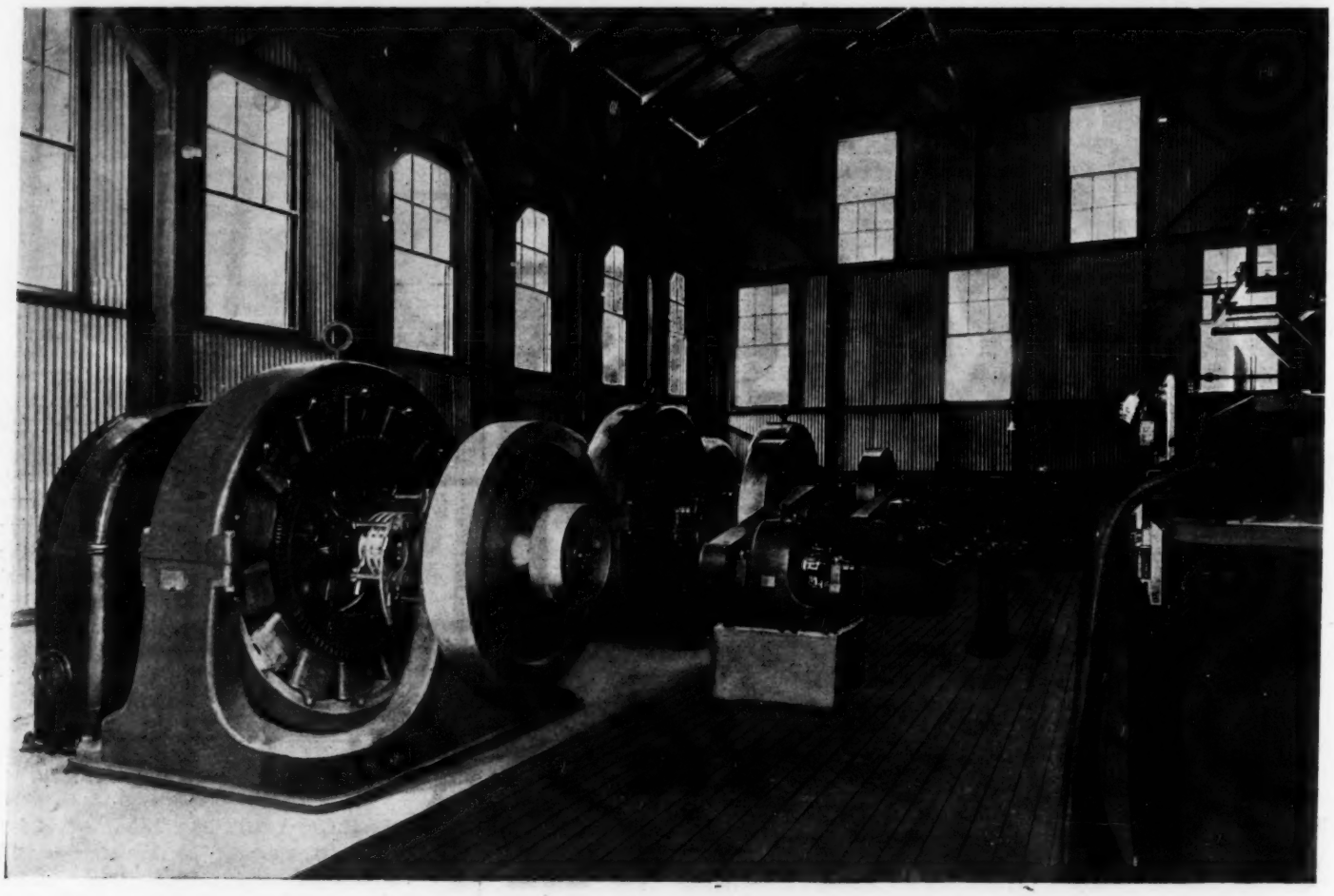


Fig. 1.—Mt. Whitney Generating Plant.

Another feature which, while by no means new, is a departure from the usual practice of the Pacific coast, is the elimination of the receiver at the lower end of the pipe line. As a means of quieting and preventing the swirl in the water—the sole purpose for which it is designed—a receiver is a failure. As a sand trap it is uniquely expensive, inefficient and inaccessible. The loss in head incurred by the sudden decrease in velocity, while not excessive, is still appreciable. In the Mount Whitney pipe, water gradually increases in velocity and acceleration from the time it enters at the penstock until it leaves the nozzle tip.

There are three generating units. The water-wheels, 50 inches in diameter and 700-hp each, are of Pelton type, with bronze buckets on cast-steel discs. These were made by the Abner-Doble Company, of San Francisco. There is but one nozzle to each wheel, and the speed is governed by a deflective hood operated by a hand-wheel actuated worm gearing, the hand-wheel being situated in front of its respective generator panel on the switchboard. The deflected water is caught by curved cast-iron baffle plates in the tail-race and again deflected down the race. The wheel housings are of cast iron, which has an advantage over the usual boiler iron in that the noise is considerably deadened.

The three generators, which are of 450-kw capacity and 440 volts, with a speed of 515 r. p. m. and a frequency of 60, are of the revolving armature, three-phase type, separately excited. As they are Westinghouse standard machines, their points are too well known to need comment.

The three water wheels are each mounted on the shaft of a dynamo, and thus the units have but the generator's two bearings. A 4000-pound cast-steel fly-wheel is overhung on one side, and the water wheel, weighing 2000 pounds, on the other. There are two 15-kw exciters, each of sufficient capacity to excite all three generators. At present the exciters are belted to the generators, each exciter being equidistant from two generators, and so can be belted from either. It was the intention of the company, however, to make a reservoir in the canon above the power house to store water from the spill-way at the head of the pipe line, for the purpose of running the exciters independently by water power; but the exceedingly close regulation of the generators' speed makes the change unnecessary, and in this instance belted exciters have proved a success.

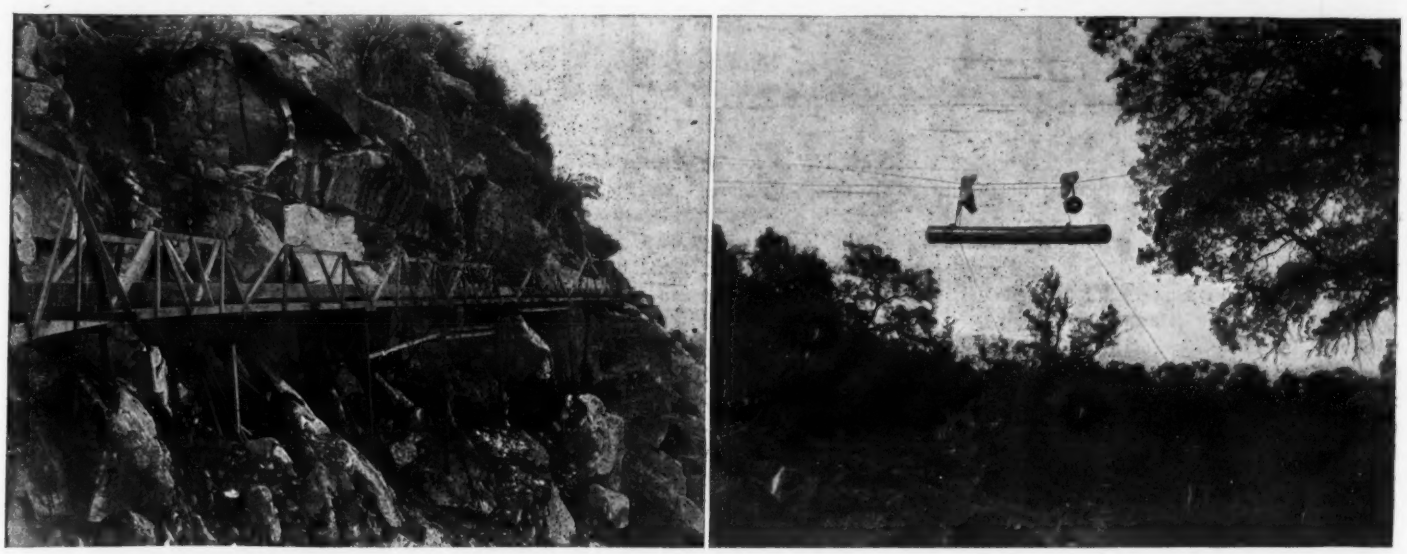
It has been the writer's experience that exciters directly connected with small 15 or 20-hp wheels operated under excessively high heads are to be avoided. A leaf or small bit of gravel in the little nozzle may cause a sudden dip in the voltage sufficient to blow many motor fuses, or even cause a shutdown with danger of the generator running away.

The voltage is transformed from 440 to 17,300 volts in three Westinghouse oil-filled, self-cooled transformers of 500-kw capacity each. One spare transformer is the only auxiliary, which can be substituted for any one of the other three. Economy in the first cost was paramount in this choice of units; efficiency in operation except at full load is of little consequence, as there is at all seasons of the year more than an ample water supply. At any time it will be possible to connect up the transformers to give 20,000 volts on the secondary or a "Y" voltage of 34,600, while the step-down transformers at the substations, which are of the Scott two-phase, three-phase type, can also be connected up for the higher voltage. The lightning arresters are situated in a small building entirely separate from the main power-house.

There are five substations in all—at Visalia, Tulare, Porterville, Exeter and Lindsay—from which are run 2000-volt distributing lines. The first three mentioned substations aggregate a very fair lighting load, both incandescent and arc, but the principal power is consumed by induction motors of from 5 to 50-hp, operating centrifugal pumps, which deliver water to the towns and to the extensive citrus orchards in the surrounding country.

One novel and especially interesting portion of the lighting system is the use of an auto-controller which prevents consumers from burning more than a specified maximum number of lights. This little device, invented by Mr. O. M. Lacey, of Hanford, Cal., consumes practically no power (about ½ watt per lamp), and does not affect the lighting service as long as the rated number of lights or less are burned; but the instant the maximum is exceeded, all the lights in the house flicker, going on and off approximately 120 times a minute. Instead of leaving the house in darkness, as the use of a fuse or circuit breaker for this purpose would do, it gives quite sufficient light for the consumer to find the nearest switch or key socket, and just as soon as the excess light or lights is turned off, the rest burn steadily. The principle upon which this appliance works is very simple. The moment the allowed amperage is exceeded, a series solenoid overcomes the pull of an adjustable counterweight, making a contact, and by operating an electric relay, breaks the circuit. The counter-weight then pulls back into place and the circuit is again closed for an instant, and so on till a light is cut off and the amperage cut down.

This is a good and very inexpensive alternative when meters are out of the question. To a flat-rate system it is very valuable, for it allows the lighting service to reach many customers that it could not otherwise. It allows a saving in transformer capacity alone which is almost sufficient to pay for its introduction.



FIGS. 2 AND 3.—SHOWING TRESTLE WORK AND TELPHERAGE LINE FOR TRANSPORTING MATERIAL.

Protection of Interior Wiring from High Potential Currents.

BY WARREN B. REED AND LYMAN C. REED.

As the use of high-tension currents is becoming more general in connection with systems of low-tension distribution fed by means of transformers, either singly or banked, or through rotary converters, the question of protecting these or other secondary low-tension systems when they become charged with high-potential current, assumes a position of paramount importance. This high-tension current may charge the low-tension systems through failure of insulation in the transforming devices, or through accidental crosses between the wires of high-tension feeders of the same separate systems. It must be conceded that with the present methods of overhead and underground construction, where high-tension and low-tension wires are in close proximity, being placed on the same poles or in the same ducts, a constant menace to life and property exists. This has been forcibly impressed not only on the public at large, but also on the electrical engineers of the country, by a long series of accidents to life and destruction of property.

Many attempts have been made to solve this problem, and many devices have been invented to this end, but a practical and complete solution has, we believe, not heretofore been offered. The efforts in this direction may be divided into three classes:

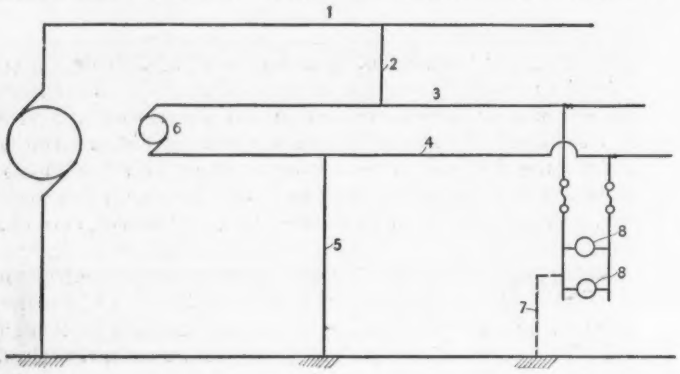
1°. The maintenance of a high insulation on both high-tension and low-tension systems.

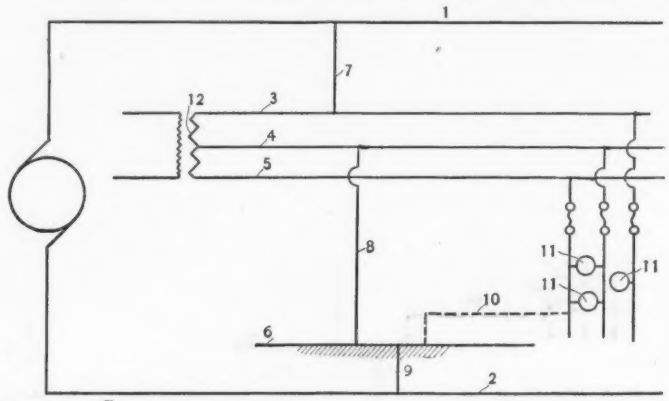
2°. The use of devices to earth, short circuit and open the affected circuits.

3°. The permanent grounding of one wire of the low-tension circuit.

It has been vigorously maintained by the National Board of Fire Underwriters that the protection of the low-tension systems, from which are fed the interior wiring, is to be best obtained by increasing the quality of insulation. And it may be said that their work in this line has resulted in many improvements in the class of materials now approved for electrical construction. A notable instance of this is the improved quality of insulation in the present transformers. When wires are installed in houses, however, there are many influences which tend to lower the quality of insulation even when it was originally of high quality. House wiring installations are not as a rule tested for breakdown limit of insulation, and, consequently, such breakdowns are liable to occur at any time. It is obvious also that it is impossible to expect house wiring, as installed for low-tension systems, to withstand the strain of high-tension currents. The general failure of this means of protection—the trusting to insulation—has been very fully demonstrated, and engineers have been compelled to look further for a solution.

Under the second class, the devices which earth the low-tension system when a high-tension cross occurs are open to all the objections which will be set forth in considering the permanent grounding of one leg of the low-tension system. Furthermore, these devices require an appreciable time in which to act, and this, together with their many other objections, therefore classes them as a poorer protection than the method of permanently grounding the system.





FIGS. 1 AND 2.—DIAGRAMS OF CIRCUITS.

Devices which depend upon the blowing of fuses are also objectionable and are commercially unreliable.

The third method—the grounding of one leg of the low-tension system—has the objection of placing a fixed strain on the system at all times equal to the potential between the grounded wire and the other conductor or conductors of the system. It has been advocated, however, by engineers eminent in the profession, as a complete means of protection from damage by incursions of higher potential under all possible conditions of crosses or breakdowns. This assumption, as will be demonstrated, is correct only for certain conditions, which may or may not exist at the time of the high-tension cross or breakdown.

In a paper read before the American Institute of Electrical Engineers by Dr. Cary T. Hutchinson, strongly advocating the permanent grounding of the secondary or low-tension circuit, as the only correct solution of the problem under discussion, use was made of the following formulæ:

$$\frac{V_1}{V_2} = \frac{C_2}{C_1} \quad \frac{V_1}{V_2} = \frac{g_2}{g_1}.$$

Where V_1 and V_2 are the potentials above and below the earth of the two wires of the high potential circuit, C_1 and C_2 their capacity, and g_1 and g_2 the conductance of any paths to earth. Therefore, in the formulas V_1 becomes zero when C_1 becomes infinite; and V_1 becomes zero when g_1 becomes infinite. For C_1 and g_1 to become infinite the resistance between the high-tension conductor and the earth must be infinitely small, otherwise there is a fall of potential between the high-tension wire and the earth, varying with the resistance imposed in the circuit to earth.

In order to bring out the practical consequences of the above, a permanently grounded low-tension circuit will be assumed, crossed with a 500-volt trolley. Fig. 1 shows diagrammatically such a low-tension circuit, 3 and 4, crossed by wire, 2, from 500-volt trolley, 1; permanently grounded by conductor, 5, and accidentally grounded at 7. If the ground return of the trolley system be considered zero, and the trolley be maintained at a fixed potential, the entire fall of potential, 500 volts, will take place over crossing wire, 2, wires 3 and 4, parallel circuits, 6 and 8, and ground, 5. It therefore follows that the potential on any point of this circuit between the trolley and the earth depends upon the relative resistance between that point and the earth as compared with the resistance between the point and the trolley. Suppose, for instance, wire 2 to have .25 ohm resistance; wires 3, 4, 6 and 8 to have .25 ohms, and earth wire, 5, to have ½ ohm; then (ignoring the potential of the secondary circuit), the wire 3 will be 375 volts above the earth, and wire 4 will be 250 volts above the earth. For the wire 4 to be the same potential as the earth, the connecting wire 5 will have to be of absolutely no resistance, or of infinite conductance. On the other side of the circuit, for wire 3 to be the same potential as the earth, the parallel circuits 6 and 8 would have to be of no resistance or infinite conductance. In this last case the entire fall of potential would be over the wire 2.

As in practice the ground connection 5 always has some resistance, and the multiple circuits represented by 6 and 8 have a variable resistance, the relative values of the resistances, together with the resistance of the cross represented by 2, determine not only the potential of the secondary circuit above the earth, but also the amount of current which flows from the crossing trolley. In the specific case assumed, the fall of potential across the low-tension circuit was 125 volts. With the increase of permanent grounds, the wire 5 may represent an exceedingly small resistance; and if the wire 2 be of very small resistance, almost the entire fall of potential will take place over the parallel circuits between 3 and 4, with the consequent wrecking of the translating devices and blowing of fuses.

On the other hand, should accidental grounds, such as 7, occur in the house wiring, the flow of current to earth will divide itself in proportion to the resistance of 5 and 7, and it is very probable that this flow of current to earth across 7 will be sufficient to blow the house fuses and cause destructive arcs with consequent fires.

Should the cross 2 take place on wire 4 instead of wire 3, the entire fall of potential between the trolley and the earth will be over the wires 2 and 5, and the potential of the wire 4 above the earth, together with the entire secondary system, will be proportional to the resistance of 2 and 5.

This potential of the wire 4, therefore, may vary between zero and 500 volts. Should an accidental ground, such as 7, occur in the house wiring, sufficient current may flow across this ground to blow the house fuses and form destructive arcs as above stated. In other words, it is seen that with a trolley cross, the conditions met in practice are such that the grounding of one wire of a secondary system does not insure protection in all cases; and in many instances this grounding of the secondary system may cause trouble which might otherwise not have occurred if the wires were thoroughly insulated.

When the crossing current of high potential is 2000 volts alternating, where both wires are insulated instead of having one side grounded, as in the case of the railway current, the diagram representing the above conditions varies somewhat. Thus, in Fig. 2, 1 and 2 represent the legs of a 2000-volt circuit separated for convenience of demonstration; 3, 4 and 5 are a low-tension system, either alternating or direct; 6 the ground; 7 the accidental cross between one wire of high tension and low tension systems; 8 the permanent ground on the neutral wire; 10 any other ground on inside wiring; 9 the leakage to ground on the other leg of the high-tension circuit.

Should the wire 9 be eliminated, the capacity discharge, in event

of a cross 7, will take place over the low-tension system to earth over wires 8 and 10, and translating devices in circuit. This discharge may or may not cause trouble, depending upon the capacity of the high-tension system and the number of translating devices through which it discharges. Should, however, the wire 2 be grounded as at 9, the high-tension circuit will discharge across this ground and anticipate any discharge to earth over a consequent cross such as 7. In this event, however, there is a flow of current between 1 and 2 proportional to the total resistance in circuit; and the difference of potential between 1 and the earth and 2 and the earth is proportional to the resistance between these wires and the earth. For the earth to be neutral to 1 and 2, their resistances to earth must be the same. For the neutral of the low tension system to be of the same potential as the earth, it must be so grounded that every point thereon has no resistance to the earth. For this to be the case, the neutral would have to be part and portion of the earth at every point, a state of affairs practically impossible to obtain with present construction.

Therefore it is seen that with a permanently grounded system, an assignable value may be given to the resistance of the neutral ground. As shown in the above diagram, any values may be assigned to portions of the circuit between 1 and 2, and consequent relative fall of potentials over the various portions of this circuit be obtained. For instance, suppose 7 to be one ohm, the parallel circuits between 3 and 4 one ohm, the permanent and accidental grounds 8 and 10 one ohm, and ground 9 one ohm. Then the total resistance between 1 and ground is three ohms with 1500 volts' fall of potential; 4 is 500 volts to ground, and wire 3 is 1000 volts to ground, ignoring the potential of the low-tension circuit. From this it is evident that the potential of the low-tension circuit to earth can be any assignable quantity between the voltage of the low and high-tension systems, varying with the varying conductances of 7 and 8 and 9. It is evident from the foregoing that if the permanent ground has a resistance equal or greater than the added resistances of the remainder of the circuit between 1 and 2, the potential from the neutral wire to earth is half or more than half the potential of the crossing high-tension circuit. And if the permanent ground be of very small resistance and the crossing wire and ground 9 be of very small resistance as compared with the parallel circuits between 3 and 4, then the main fall of potential will take place across the translating devices. In either case, the grounding of one leg does not afford a protection under conditions which are met in practice.

In order for the low tension system to be adequately protected under all conditions when brought into contact with high-tension currents, it is necessary that the house wiring be disconnected when its potential from earth rises above a predetermined safety limit.

It is demonstrated above that if a ground of small or no resistance be placed on one leg of a system, the opposite ungrounded leg may attain a voltage destructive to the translating devices in circuit; therefore, such a ground becomes a menace when the ungrounded legs of the system become crossed. And it was further shown that if the ground is given an appreciable resistance as compared to the other resistances in circuit, all of the wires of the low-tension system assume a dangerous voltage above the earth, hazarding life and property.

If such grounds, however, be placed on one leg of a system, so that the fall of potential over these grounds be made to operate devices in circuit therewith, arranged so as to disconnect the service circuits individually when this fall of potential to earth reaches a predetermined limit, the problem is solved. For when the resistances of the remainder of the circuit between the two legs of the high-tension current are such that the fall of potential across the grounds and translating devices of the low-tension system is under the predetermined limit of safety, then no danger exists from the high-tension cross, and the grounds protect the system; but as soon as the relative resistances vary, so that the potential on the low tension system to earth rises above this safety limit, the house circuits are at once cut off.

A device to fulfil these requirements must operate with equal efficiency on both direct and alternating current, and at the same safety limit. It must be quick-break and non-arcing on high-tension currents; must not be a current consumer, either before or after operating; must not be frail or liable to get out of order, and must not require attention or adjustment. Until the individual house circuits are equipped with such a device, grounding in this manner one wire of the low-tension systems, no absolute protection can be obtained.

The extreme reluctance upon the part of the National Board of Fire Underwriters to adopt the permanent grounding of one leg of a system as the best means of protction, shows that they have been aware of the defects inherent therein. As the time is approaching for their annual meeting, and as a resolution has been passed by the American Institute of Electrical Engineers urging upon the Underwriters the amending of their rules to adopt the grounding of one wire of a low-tension system, the question as to its advisability becomes of great interest and should be given careful consideration.

A Multiple Lightning Flash.

By A. E. Kennelly.

THE accompanying cut is a half-tone reproduction from a photograph of a remarkable multiple lightning flash made by my friend, Mr. J. M. Justice, who is an excellent amateur photographer, and who has interested himself in photographing lightning during the last two years. I have obtained from and with him the following particulars:

Mr. Justice's house is in Frankford, Pa., about 6½ miles N. E. of the City Hall of Philadelphia. From his windows he commands a clear view of the surrounding country from west round by north to east. Between 9 and 9:30 p. m. on the evening of the 10th of August last a thunderstorm approached from the north. He set his camera firmly on a tripod in front of an open window and made exposures of 6½"x8½" Cramer Crown Plates, using a lens of 10 inches focal length. Nine plates were exposed in all, and the photograph here reproduced was on the eighth plate. The length of

MULTIPLE LIGHTNING FLASH.

the flashes increased on the successive plates as the storm approached, and the ninth or last plate showed more than 5" of flash, although only part of the flash was caught on the plate. The flashes appeared to pass between sky and earth. The storm passed almost overhead. At the time of taking this eighth plate the wind at the house was blowing in gusts from the northwest and heavy rain had fallen steadily for about ten minutes. The camera faced roughly northeast. The exposure had only been made a few seconds on this plate at about 9:20 p. m., when the small single flash appeared which is seen on the left of the centre of the picture. In a few seconds more the multiple flash appeared. It was vivid, very broad, and seemed to persist longer than an ordinary flash. Mr. Justice, who is accustomed to count seconds with a clock in photography, happened to be counting seconds, without a clock, at the time the flash appeared, and gave it as his impression that the thunderclap followed the multiple flash in rather less than two seconds, and certainly in less than three. The cap was then immediately put on the lens, and the

plate removed. The ratio of principal focal length of lens to the diameter of the diaphragm with this exposure was 32; or, in photographic parlance, $f = 32$. The plates were developed with the ordinary pyrogallic-acid developing solution. They were not intensified, retouched, or altered in any way. Mr. Justice showed me the negatives on the following day. Two plates showed duplicate flashes, i. e., flashes that were found, on close examination with a magnifying glass, to consist of two bands of light running side by side with a dark or blank space separating them; but the eighth plate, here reproduced, showed a multiple flash of fourteen distinct bands. The half-tone picture will not bear magnification, as will the original negative, but is a full-sized positive reproduction of a portion of the negative. The fourteen flashes are to be separately traced on the negative, from the top of the band, where they are first visible, at an elevation of nearly 10°, and where the band is broadest, down to a point about 1°.45′ from the base of the band, where the width seems to be so far reduced that they merge together into a single broad ribbon of light about 18 minutes in angular breadth. The spacing between the flashes in the band is not regular, but the relative intervals are fairly well maintained throughout. It can be observed in the half-tone that the ripples in the band are reproduced in each and all of the separate or component flashes, in such a manner that the ripple-crest lines make an angle of about 18° with the horizon dipping from left to right. The general illumination of the landscape by the flash was sufficient clearly to reveal in the negative the outlines of the trees in and near the horizon. All the outlines thus revealed are very sharp and clear, so that a weathervane on a barn tower on the left-hand side, can even be distinguished in a manner sufficiently clearly to indicate that the wind must have had at the neighborhood of the flash, a direction roughly parallel to that at the camera.

By angular measurements between prominent objects shown on the plate, made with a sextant, and also with a transit, the angular distances of the picture are known to a fair degree of accuracy. On the half-tone one inch represents 308 minutes of arc or 5°.8′; or one degree is represented by 0,195″ approximately. (One centimeter = 121.2 minutes = 2°.1′ nearly; so that 1° = nearly 5 mm.). Consequently linear measurements from the printed reproduction may be converted by the reader into angular measure.

The level of the base of the flash where it passes into the trees at the horizon is about 25 feet above the level of the camera. The bearing of the centre of the flash from the camera is 54°.15′ E magnetic, or about 49°.15′ E true; and, for very rough purposes, northeast. The trees on the horizon are approximately 2200 feet (670 meters) from the camera.

With the aid of a transit instrument, the line of bearing was carried through these trees, which are in the Cedar Hill Cemetery. The line was carefully followed to a distance of more than a mile from the camera without meeting with any injured tree, or other indication of the base of the flash. The exact distance of the flash remains, therefore, uncertain; but it must have been greater than the 2200 feet (670 meters) to the trees on the horizon, immediately behind which the flash appears to sink; and it must have been less than 3400 feet (1035 meters), if Mr. Justice's three-second outside limit is correct, while his two-second estimate would place it at 2200 feet (670 meters). The mean estimated distance assumed for definite provisional discussion, is 2600 feet from the camera (790 meters).

The angular breadth of the multiple flash near the summit in the clouds is about thirty-two minutes, and at the base on the horizon is about eighteen minutes, as shown on the negative or half-tone. This represents, at 2600 feet distance, a summit breadth of about 24.5 feet (7.5 meters), and a base breadth of 13.6 feet (4.15 meters). The visible height of the flash is nearly 10° on the negative, representing 458 feet of vertical height (140 meters) approximately, at the same distance. All the breadths and heighths are proportional to the assumed distance, and if the flash were twice as far from the camera, or 5200 feet distant, they would all be doubled.

Having stated the facts as closely as possible, it becomes permissible to speculate upon the cause of the phenomenon. The appearance on the plate cannot have been caused by a movement of the camera in the presence of an oscillating discharge, because in that case the images of the landscape would also have been multipled, whereas all the objects in the landscape are very sharply defined. The shape of the band is opposed to this hypothesis, as also the spacing of the components. There seems to be no escape from the conclusion that the band had a real existence of angular breadth as above stated, but with a linear breadth which is known only when the distance is known.

If the velocity of the wind at the position of the flash had been 30 miles per hour (48.3 kilometers per hour) across the line of sight; then the distance of 25 feet, the summit or maximum breadth would be traversed in 0.568 second of time, or a little more than half a second. The phenomenon might, therefore, be accounted for, by supposing that a flash passed through the air on the left hand side of the band, and broke a hole in the air along that line. This discharge may, perhaps, have been oscillatory and may have lasted, in all, any time up to about one-hundredth of a second. The discharge then ceased for lack of electricity, but fresh charge from the cloud being gathered immediately afterwards or in about 1-30th of a second from the first rupture, a new discharge passed through the same hole in the air, which had not had time to seal up. There might thus be fourteen successive flashes, each averaging about 1-25 of a second apart, through the same hole, owing to the imperfect conducting qualities of the clouds overhead. Meanwhile the hole had been carried from left to right in the picture, across the line of sight, to a maximum distance of 25 feet. The narrowing of the band near the ground might be due, either to a reduced wind velocity at that point, or to a twisting of the plane of the band, or to a convergence to a single discharging point on the earth. The angle of 18° on the ripples of the band would represent that the column of air pierced by the first flash had a downward component of velocity if the first flash was on the left; or an upward component of velocity if the first flash was on the right.

Consequently it would seem that the flash might be explained, at a distance of 2600 feet, by a persistence of successive discharges for about half a second, with a wind velocity of not more than thirty miles an hour across the line of sight. Even if the flash was as far as one mile from the camera, which is probably an outside limit, only about one second of duration would be required to account for the phenomenon with the same assumed wind velocity. It is certainly a wonderful picture.

The negative also shows faint *light* flashes between the single and multiple flashes. These would represent faint dark lightning flashes; but they seem to have no direct connection with the multiple flash.

Cost of Operating Automobiles.

The London *Daily Mail* recently published an article giving costs of operation of automobiles. As this subject is one of growing importance, the main points of the article will no doubt be of interest to those concerned. The information comes from Mr. E. H. Bayley, who, the *Mail* states, is entitled to speak with some amount of authority, as he was chairman of the London Road Car Company, and now, in addition to employing 1000 or so horses in his own business, is chairman of a gasoline motor company, and takes a keen interest in all that tends to lessen the cost of heavy traffic. "Of course," he said, "no matter how excellent motor-driven vehicles may be, no one would look at them seriously if their use were more expensive than that of horses. That is exactly where the ultimate success of motor vehicles lies, for the tests by the Automobile Club at Richmond and, more recently, those held by the Liverpool Self-Propelled Traffic Association have shown that not only can motors do general carrying work more quickly and more efficiently than horses, but—most telling point of all—do it at less than one-seventh of the cost. For instance, we have a car which has been proved, under the tests already mentioned, to be capable of carrying a load of 3 tons 12 cwts. at a cost for fuel which works out a half-penny per ton mile. The total upkeep of such a vehicle, when all expenses for working, wages, fuel, repairs, insurance, etc., are taken into consideration, comes to a sum of £407 0s. 3d. ($1,980.73), and this, with a carrying capacity for two hundred and sixty working days, gives an average cost of a fraction under 3 half-pence (3 cents) per net ton per mile. When that is compared with the cost of horses—my experience teaches me that it varies from 9d. to 1s. (18 cents to 24 cents) per ton per mile—it can be seen what a future such vehicles have before them. In this branch of automobiles England has the lead, and presently she will not be so far behind with light carriages, for the company referred to is taking up the question of building racing cars to compete with those of French make. Already three orders for cars costing £1000 (4866.50) each have been placed, which shows that English enthusiasts are prepared to support home industries if given the opportunity." The London *Daily Mail* is publishing an automobile column once a week.

Annual Meeting of the American Street Railway Association at Chicago.

THE opening exercises and leading features of the Chicago Convention were duly noted in telegraphic despatches from that city to this journal last week, and a full report is now appended. A description of such of the exhibits at Tattersalls' as were of interest will also be found elsewhere in this issue. Not only was the convention well attended, but the interest in the proceedings was well sustained throughout the week, so that in spite of the profuse hospitality, the regular business was disposed of systematically.

Kansas City, Mo., was named as the next place of meeting, and the following officers were elected: President, John M. Roach, general manager Chicago Union Traction Company; first vice-president, John A. Rigg, president Union Traction Company, Reading, Pa.; second vice-president, H. H. Vreeland, president Metropolitan Street Railway Company, New York City; third vice-president, F. G. Jones, vice-president Memphis Street Railway Company, Memphis, Tenn.; secretary and treasurer, T. C. Penington, treasurer Chicago City Railway Company. Executive Committee: President, vice-presidents and C. S. Sergeant, second vice-president Boston Elevated Railway Company; C. K. Durbin, general superintendent Denver Consolidated Tramways Company; Nicholas S. Hill, general manager Charleston Street Railway & Electric Company, Charleston, S. C.; Charles W. Wason, president Cleveland, Painesville & Eastern Railway Company; John R. Graham, president Quincy & Boston Railway Company, Quincy, Mass. A biographical sketch, with portrait of Mr. Roach appears in this issue.

On Tuesday evening there was a reception at the Auditorium. On Wednesday afternoon a special train took a party of over 500 ladies and gentlemen on a trip over the line of the great Drainage Canal, from the Chicago River to Lockport, a work on which nearly $35,000,000 have been spent. The main channel is 28½ miles long. Besides draining the sewerage, it may be used for shipping, or it may be utilized for power purposes, it having an ultimate capacity of 600,000 cubic feet per minute, which under even slight head would, of course, give considerable power. At present, navigation with locks is looked on favorably, but all awaits the opening of the canal in December and the decision of the United States engineers.

On Thursday afternoon a big party visited the stockyards, and in the evening all went to see "His Excellency the Governor," the whole Columbia Theatre having been taken by the generous local hosts. Friday was given up to the exhibition of supplies, and the day was well started by a large body of Chicago street railway employees marching into Tattersall's headed by a drum corps, with flags and banners, as an expression of their welcome of the delegates to Chicago. The universal experience of the supply men was that they had done more actual business at the convention that at any previous one, and they had lots of orders to prove it. At a special meeting of the supply men held in Convention Hall, Oct. 19, with Elmer P. Morris, chairman, and H. C. Evans, secretary, resolutions were passed commending the action of Ira A. MacCormack, of the Executive Committee, for recommending and having adopted the resolution, setting aside one day for the express purpose of inspecting the exhibits. At this meeting a vote of thanks was also extended to the Association for their courteous treatment in behalf of the supply men.

The annual banquet was held at the Auditorium on Friday evening with wonted success. A notable innovation was the installation there of the new officers, rather than as before at the close of the business exercises in presence of a few members hurrying to break way. In this manner the banquet became a part of the regular convention proceedings, and marked their close. Another new departure was the opening of the membership to elevated railroad companies, a privilege which is to be availed of, it is said, and which marks another evolution of the street railway industry.

PAPERS, DISCUSSIONS, ETC.

The report of the secretary and treasurer showed that there was a balance of $5,658.87 in the bank on Oct. 11, 1899. The receipts during the past year were $7650 and the expenditures $5648. The present membership is 172, seven new members having been added during the year and eight withdrawn, some of the latter representing roads merged into others. It was decided by vote that any elevated railway company is eligible for membership.

The first session of the convention was called to order on Tuesday morning, President Charles S. Sergeant in the chair. An address of welcome was delivered by Hon. H. S. Taylor, representing Mayor Harrison. He spoke of the rapid development of electric traction in Chicago and of the advantageous effect on commercial and social life. "We are gradually passing out of a walk," he said, "into a trot, and the trot is merging into a gallop, thus rendering the problems of intramural transportation more important and more complicated." He humorously referred to his capacity as Public Prosecutor of the municipality, and said that while the citizens of Chicago recognized the fact that the street railway man is becoming a very rapid citizen, he officially assured the convention that no extraordinary precaution had been taken on account of the presence of the convention in Chicago.

After the transaction of some routine business, President Sergeant addressed the convention. He drew a comparison between the electric railway situation now and when the convention met in Chicago, 1883. At that time there were 153 miles of single track in the city. At present the mileage of surface street railways is about 736, of interurban street railways about 261 and of elevated railways about 100 miles, making an increase since the former meeting of the convention of 944 miles of track. Reference was made to the present tendency toward the consolidation of small competing roads into a large homogeneous system. This, he said, is the result of the introduction of electric motive power, which involved such changes of administration, system and service that the advantage of combination with rivals became more and more manifest. President Sergeant, in referring to the prejudiced opinions against public service corporations and the misinformation promulgated concerning them, which results in reducing their ability to adequately serve the public, called upon all those having connection with electric railway industry to seize every opportunity to refute the current fallacies put forth, and to meet the self-styled "economist" on his own grounds and show him that the "quasi-public" corporation is the greatest public benefactor and social reformer that the world has ever seen.

Mr. Charles T. Yerkes, in the opening paragraph of his paper on "Investments in Street Railways. How they Can be Made Secure and Remunerative," said that he took a great interest in the question for the very good reason that about all the investments he had were in street railway securities, which indicated how great his faith is in the street railway. From his experience in street railways, dating back almost forty years, he drew a contrast between the earlier situation and that of to-day. In the early sixties, employees were worked from 14 to 17 hours out of the 24, and the roads were of a cheap character, though equal to the demands of the public and the then requirements of street railway transportation. A car register was unknown and the street railways in each city were owned by a few influential persons, generally men of large means, the stocks and securities being but little distributed. It was not until the early seventies that the banks would receive street railway stock as collateral. In those days opposition to new roads and extensions was very strong on the part of people in the vicinity of proposed locations, and particularly on the streets where rails were to be laid.

About 1880 when consolidation of different roads came to be more in fashion from the economies produced thereby, street railway securities became active. Mechanical propulsion of street cars had attracted the attention of the whole civilized world, and the question naturally arose in the minds of those witnessing these changes and having money to invest: "Isn't this a good place to invest our money, and isn't there a profit in it?" The change in the motive power propelling the cars, and, in fact, the whole outfit of street railways, amounted to a revolution. To look into the history of street railways of twenty years ago and see the changes which have taken place is, he said, certainly wonderful.

"I can see before me a plant that was run with one-horse cars, a driver and no conductor, a pay-box in the front of the car, where the passenger was required to advance and deposit his fare. I see that line changed to two horses and obtaining the diginity of a conductor to collect fares from passengers. That was a great improvement, and then we had straw in the bottom of the cars in winter—not overly clean, because we could not afford to put fresh straw in every day, but still this was a luxury—an oil lamp at each end of the car which supplied the double purpose of lighting the car and showing the signal on the outside. We went at the rapid rate of six miles an hour when we could make it keep on the track. The motion of the car was most agreeable to a person who desired to ride on the billowy waves. We see this changed, so that the track was smooth, the straw was taken out, floor always clean, and a stove giving comfortable warmth placed therein in winter time. This was advanced

luxury. We were pleased with all this, except when the snow would come, or the days were hot in summer, when the horses were not able to pull us to our destination.

"We see another change. The great power of electricity was brought into use, the horses were gone, and instead of making our six miles an hour we could go twice that rate. The oil lamps were removed and electric lamps put in their places. As like begets like, the condition of the cars was improved, cleanliness—always an adjunct to electricity—was substituted for uncleanliness. The districts of the city were expanded, lines were made in the suburbs, creating new towns, improving the property of the people, increasing the amount of assessment on real estate, until we seemed as though we were living in another world. Aladdin's lamp did not produce any more wonderful changes; and this could not have been done had it not been that the attention of investors, both great and small, had been attracted to the street railways.

And what of the great benefits to the people? Instead of the slow, uncomfortable manner of travel, rapid and easy means are given. Points that could not be reached with the old system are brought within easy access. Everything is better and cheaper. While in days gone by it cost five cents to travel three miles, with the new improvement, four times that distance can be traveled for the same money. Then it cost a person to ride about two cents a mile, now it costs one-half cent per mile. Why, then, I ask, should not a continuance of this condition be encouraged?"

As to how street railway securities can be made secure and remunerative, the main requirement is hard work and close attention to the corporation. Receipts cannot be much increased as they come from natural causes, but expenditures can be controlled, and to do this, together with knowing when and what to do, is really the science of street railway management. But to make securities secure, the justice of the people must be depended upon, and there must also be a willingness to do what is fair towards the public. The most important matter in regard to the security of street railway securities is the length of charter under which they are operating. If a company has a charter with but a few years to run, the improvements will be of a cheap character, while, on the other hand, the better the improvement, the better it is for the people—not only for those who own their property, but for those who ride and have no property. The charters of street railways should be equal to those of steam roads, and, in fact, they should be longer. The cost of a steam railroad to-day is not nearly equal to the cost per mile of a street railway, even counting all the appurtenances that go with each. The electric railway plant costs almost ten times as much as the horse car plant, and therefore if it is right to give the latter a charter for twenty years, the electric railway should receive a charter for two hundred years and city ordinances to correspond.

As to the argument that if grants are made extending over a long period of time, other means of transportation may come into existence and these charters would interfere with the adoption of improved methods, the question was asked, Supposing fifty years ago perpetual privileges had been given to operate an exclusive omnibus system in Chicago, or similar privileges had been given to operate ferries across the Chicago River, what would they be worth to-day? The charters would long ago have been forfeited simply because improved methods had rendered them worthless.

Mr. Yerkes said that while he felt that the legislatures should treat the street railway fairly, he also felt that the street railway companies should treat the municipalities and state in the same spirit. He believes that a fair amount of the earnings of the company should be given to the municipalities in which they are located. He considered that every state wherein there are large cities which necessarily have important street railways, should have a commission appointed to ascertain the condition and requirements of this industry. The commission should be appointed by the Governor of the state and should be composed of intelligent business men, of first-class standing who are not interested in street railways. Under no condition should a person be named who holds office or who is ambitions to do so, as a man of this character is not to be trusted in any affair where courageous opinions are expected. The duties of this commission should be to see that the laws concerning street railways are carried out and that the companies have the protection to which they are entitled by law. The commissioners should have terms of fifteen years so as to insure their becoming experts, and to receive such salaries as to enable them to live well and take care of their families in a good manner. They should have the power to dictate to the street railway companies where new roads should be laid, if at all, and also the kind of new improvements that should be used where a railway contemplated making any change in motive power. They should have the power to regulate the devices to be used for saving life and preventing accidents. Their reports would be explanatory and much of the ignorance regarding street railways which is fostered by its enemies, particularly in this country, would be done away with. In conclusion, Mr. Yerkes said that by no means the least important way to make securities more secure is to hold in the kindest regard the faithful employees, that there may be a perfect harmony between them and the management.

The discussion of Mr. Yerkes' paper was participated in by Messrs. H. H. Vreeland, J. I. Beggs, C. B. Wyman, T. H. McLean, E. C. Foster, F. G. Jones and N. H. Heft. Mr. Wyman referred to the fact that one-third of the invested wealth of the civilized world is to-day placed in steam and street railways, not an inconsiderable portion being in the latter. He considered that boards of directors should include men not only of financial responsibility in the community, but also men of high probity and of recognized position in the community. He believed the publication of railway operations is beneficial for all those interested in the companies, whether to a large or small extent. A plain, simple and thoroughly understandable method of bookkeeping should also be adopted which will render the accounts clear and thoroughly comprehensible to any stockholder. Reference was made to the importance of providing a depreciation fund, for which a certain amount of money should be set aside annually to make good the current depreciation of the plant. While it is always to be hoped that the increase of receipts will take care of the repairs and depreciation, nevertheless, it is well to be on the safe side and to begin to provide for it by means of a depreciation fund.

Mr. Beggs confined his remarks to the subject of short-term franchises and provision for retiring securities at the termination of a franchise. The Milwaukee street railway property, of which he is manager, has a little over twenty years to run, and a certain amount is annually being set aside for the payment of the securities of the road when the franchise ceases to exist. He also called the attention of the members to the necessity for making a proper provision to take care of future repairs and reconstructions. He dwelt on the necessity, in order to make street railway securities safe, of having the public take them as they do water-works and gas stocks, nearly all of which public services, however, have perpetual charters. The longer a franchise has to run the more money can be spent upon the betterment of the system and in increasing its facilities. In conclusion, he again referred to the necessity of giving security to street railway investments by making some provision for the bonds when the franchises have expired.

Mr. Vreeland in his remarks said that the question of management suggested the consideration not only of average revenues but of average expenditures. Another important point was to secure the proper man to manage the property, who should also be one who could meet the local municipal conditions and the state conditions—the general conditions as affecting the properties so far as legislative and municipal affairs were concerned. He should also be a man who can take care of the financial part and the operating side, and do it with very little assistance. Mr. Vreeland said that coming from the steam railway school where reports submitted to the directors or president gave an analysis of every important detail, he was surprised to find how little attention was given to these points in the street railway field. Proper publicity in this respect, he believed, was necessary in order to let people know what they are buying and what values they are receiving.

The labor question, Mr. Vreeland said, he considered to be the life of the street railway. The transportation questions, except as represented by labor, are insignificant as compared with the great problem of handling labor. The question is one requiring a great deal of energy and ability, but if satisfactorily handled it is one of the greatest elements of strength in the street railway management. The success of investments is in the confidence of the stockholders with respect to relations with the general public. For if there are labor questions to confront the property this year or next, not only may the result be to wipe out the dividend, but also the entire earning capacity for that period and permanently disturb the smooth working conditions necessary at all times.

Mr. Foster considered the subject to be one of far more importance to those operating street railways in the western states than in Massachusetts. In that state there is a Board of Railroad Commissioners who have supervision of street railways, and a franchise is granted without limitation, subject to revocation by the local au-

thorities and approved by the Railroad Commissioners. It would be absurd on the part of the Board of Railroad Commissioners to revoke a charter on which they had based their approval of the issue of securities, and such approval sets a seal upon the securities. He considered that the laws of the State of Massachusetts protected investors and led to placing dividend-paying street railway stock under the head of stable securities.

In reply to a question by Mr. Yerkes, asking if it is not a fact that the Massachusetts courts had decided that a revocation of franchise cannot be put into effect unless it can be shown that the roads are not needed by the people, Mr. Foster said that it would have to be shown that public necessity and convenience required the removal of the tracks, otherwise it could not be done. He only knew of one case where a franchise had been revoked, in which case another was substituted for it, and the line not affected.

Mr. Heft said that in looking up the matter of weights, he was horrified to find that for every passenger hauled with a modern street railway equipment, 721 pounds of dead weight were also hauled, which is only 137 pounds less than the standard steam railroad equipment. He considered that street railway managers should turn their attention to the question of equipment and see if they cannot get rid of some of this weight, and added that his company expected to operate within the next few months a car which, including the entire equipment, will not exceed 227 pounds per passenger.

In a paper on "Train Service and its Practical Application," by Mr. Ira A. MacCormack, it was pointed out that mapping out the train service of street railway systems presents an intricate problem, owing to the different conditions as to traffic, both with respect to number of passengers and rush of traffic at certain periods of the day. It is recommended that conductors be supplied with a blank to be filled in with certain data which, supplemented by data from another form of blank filled in by inspectors, will enable the conditions of traffic to be provided for by a properly regulated service. The paper, which is quite lengthy, goes into all of the details of regular train service, discussing the influence on it of the location and service of power houses, the operation of cars, the selection of motormen, etc.

The discussion of Mr. MacCormack's paper was participated in by Mr. Holmes, of Kansas City; Mr. Vreeland, of New York, and Mr. Heidelberg, of Chicago.

Mr. Holmes said that his company had adopted the plan of setting aside a portion of Monday morning from 9 to 12 o'clock to receive applications for employment, when the division superintendents are present to look over the men as they pass through the office. He thinks it is wise for the superintendents to be present when employing men. The men, after being selected, are required to make out an application, stating where they have worked, and giving such references as they are able. His company has arranged to give this winter a course of lectures to the men on the practical applications of electricity, and if the employees want to take a course in electricity, the company will be glad to see them do it. He believes in employing young married men, and using great care in the selection of employees, for the reason that they are the only representatives of the company with whom the public come in contact.

Mr. Vreeland was called upon to give some information as to how so many cars are run on Broadway. He said that last year his company moved 265,000,000 cash passengers and 90,000,000 transfer passengers, or a total movement equaling the whole of that of steam railroads of the United States. The system is handled with reference to time tables, and the preparation of these requires the services of an expert employed for that purpose. As an illustration of what care must be given to the question of traffic, he said that an investigation led to the conclusion that on the East Side of New York the large car service should be started at 6 o'clock in the morning, while on the West Side it need not be started until 8:30 o'clock. Previous to the investigation very nearly the same service was rendered on both sides of the town. It was found impossible even on short distances to keep up the voltage of the lines during the hours of heavy loads, which affected the time tables, and this was corrected by putting in a 4000-hp storage battery which automatically regulates the voltage. He said that traffic diagrams are taken at least every two weeks for every division of the system for the twenty-four hours, and a copy furnished the general foremen and inspectors, as well as the man who makes out the time tables. In determining these curves it is necessary to station special inspectors at certain points. Referring to the abuse of transfers in Chicago, Mr. Vreeland said that in walking uptown during the convention, he stopped in a drug store to buy a cigar, and when going out was offered a transfer, the transfer going with the cigar.

In a paper read by Mr. Edward Butts, on "The Construction and Maintenance of Street Railway Tracks," the treatment is confined to tracks built according to the latest practice and in the most permanent manner. The rail should not be less than 6 inches in depth with a width of base equal to the exposed upper surface. Where streets are paved with asphalt and a stone toothing course placed adjacent to the rails, the latter should be at least 9 inches in depth in order that the base may be securely embedded in the concrete below. The rails should be centre-bearing, rolled in 60-foot lengths, and handled so that they will be perfectly straight when placed in position. Tie rods 1 inch in diameter should be placed along the line, with 6 feet between centres and supplied with hexagon nuts clamping the rail securely on both sides. The reason for this rigid tie rod is that the pressure on the outside of the rails due to street traffic should be provided for as well as car thrusts on the inside.

The rail trench should be 20 feet wide at the top and 6 inches wide at the bottom, with enough depth to give 6 inches below the rails. The concrete placed in the trenches around the rails should be composed of crushed stone measuring not more than one-half inch in greatest dimension, mixed with Portland and domestic cement and sand, the concrete imbedding the base of the rails up to the bottom of the proposed paving. The concrete mixture should consist of two parts of sand, one-half part of Portland cement, one-half part of domestic cement and five parts crushed rock, all by cubical measurement. The concrete, which should be allowed about six days in which to set, should be thoroughly tamped till mortar flushed to the surface. Cast-weld joints are recommended, which, on 80-pound rails require 150 pounds of metal and on 100-pound rails 200 pounds, the metal being composed of two-thirds pig iron and one-third common scrap iron. The metal should be heated to a bright yellow temperature and each joint formed with one pouring.

In the discussion of Mr. Butts' paper, Mr. Foster said that it is necessary to construct the tracks of street railways differently according to the type of road, and that Mr. Butts treated of but one kind of track, and that for metropolitan service. Where cross ties are used—and over 90 per cent. of street railways are using cross ties—they should have about the same dimensions as the ties used on steam railroads. On five miles of track now being constructed by his company, steam railroad ties are being laid and a 70-pound rail used having the "American Civil Engineers' section." He advocated the use of a long tie, and questioned the wisdom of applying cast joints to 26-foot rails. In reply to a question, Mr. Foster said that the chestnut tie gave the best results.

Mr. Keating, of Toronto, said that he had occasion to construct some lines on a concrete foundation where the traffic has not been excessively heavy, and the results so far have been very favorable.

Mr. Butts, in reply to a question, stated that he had been connected with a road for the past four years, the track of which was constructed as outlined in the paper, and there was no perceptible yielding of the rail. As to the cast-welded joint, he said that the method employed by him had been to put the concrete around the rails before the welded joint is put on, an aperture being left at the joint. After the concrete has set a sufficient time, the joint is cast-welded.

Mr. Mason, of Cleveland, said that his experience in that city with cast-welded and electrically-welded joints had not been so satisfactory as with the use of a 12-bolt fishplate.

Mr. MacGregor, of Houston, referred to the fact that the big roads are setting the pace, and the little roads are expected to come up to their standard. Recently the former had started out with four motors on the cars, which would be a disadvantage to a road with small business. He believed that if the members could get themselves into two classes, those whose roads have all the business they can handle, and more too, and another comprising the smaller roads, the discussion might be made to fit the case of each.

Mr. Heidelberg, of Chicago, said that his company was the second to use the cast-welded joint, which has given eminent satisfaction. As to ties, he has found that the creosoted cedar or hemlock tie is the only one to use in sand, whereas in clay soil white oak is the best. He stated that Chicago cable companies have their tracks laid in concrete, and after from 11 to 15 years it rots out and crumbles. Referring to cast-welded joints, he said that his instructions to his men were to pour no metal into a mould unless it was at a white heat. The essential point is that after sand blasting the joint and getting all the pits of the rail perfectly clean, the metal must be put in very hot in order to flux and amalgamate with the rail.

Following Mr. Heidelberg, Mr. Butts said that in cable construction the rails are not embedded in concrete, but supported entirely by their yokes, and consequently the application of the concrete con-

struction as applied to cable railways does not apply to concrete trench construction as understood by street railway men. The yoke construction is not rigid, and the vibration will wear out the concrete. Concerning the bonding of rails, the welded joints have the full electrical capacity of the rail; where this joint is not used a No. 0 bond should be put in.

Mr. J. H. Van der Veer, in a paper on "The Care of Car Equipment," stated that where almost continuous service is demanded and high mileage made, only equipments fitted with oil and grease boxes will safely run over forty days without a thorough overhauling. Large roads will require overhauling shops at different points, at which there should be extra trucks with motors mounted ready to run under a car whose trucks or equipment need overhauling. The whole operation of substituting a new truck need not take over about one hour. As to general inspection, a car started out in perfect order will safely run five days without inspection. It is recommended that in inspection one man should be responsible for all the trolleys, another for all circuits and circuit appliances, and another should give his whole attention to the controllers. Mr. Van der Veer believes that it will pay railway companies to make all their own repairs to electrical apparatus, including the making of armature coils and renewal of commutators. In connection with the latter, he states that he has found hard-drawn copper to make the best bars. The copper is bought in lengths and the bars sawed off with an ordinary metal saw, and it has been found that the same bar will often do for several types of commutators. He recommends that wherever practicable all repairs should be made by piece-work.

In the discussion of Mr. Van der Veer's paper, Mr. E. B. Connette said that he had applied the steam railroad method to the inspection and maintenance of street car equipments. When a car comes in from its work at night, having run perhaps from 100 to 150 miles, it is first cleaned, then all the parts of the motor, including the wire connections, brush contacts, and all the parts of the truck, are properly inspected, loose parts are tightened up and all minor repairs made so as to prepare the car for its service on the following day. His experience justifies him in saying that this method has been entirely satisfactory. While it is true that daylight inspection has some advantages, with a limited car equipment, however, and car barns located in such a manner as to be inconvenient for the cars to run in during the day from time to time for inspection, it becomes necessary with some companies to do the work at night. In case of disablement of a car during the day, if the defect is caused by lack of inspection at night, the night inspector is held responsible. It is a rule for his company to give the motors a general overhauling perhaps once in six months. He said that about two years ago during an exposition in Nashville, the road was worked to its extreme capacity with trail cars behind every motor car, and a headway of from one to one and one-half minutes regularly; during the six months of the exposition there were but six motors disabled, and he thinks this record justifies him in saying that the application of steam railway methods to street railway service have been extremely satisfactory.

Mr. W. E. Harrington, of Camden, N. J., said that on his road, which operates thirty-three cars, the bulk of the inspection and the making of minor repairs is done at night. The general repairs, carpenter work and painting are done on the piece-work system, which has proved very satisfactory. In adopting the piece-work system, not having a precedent, difficulty was encountered in establishing prices, which was overcome in the following manner: "If we set a contract price for a piece of work, say five dollars, and the work was actually done for two dollars, that would make a profit of three dollars, which would be entirely disproportionate; so we settled on a limitation of that to 20 per cent. of the actual cost. If the work cost two dollars, and the contract price is five dollars, the actual bonus would be forty cents; whereas, if the cost exceeded five dollars, the loss would not exceed 20 per cent. of the actual cost price. That seemed to satisfy the shop men, and enabled us to settle quickly this question; and it has been very satisfactory in its operation. We followed this same practice in our construction work, as well as the repair work, and in every respect it has been very satisfactory."

He stated that his company is washing 18-foot cars for 15 cents a car, including sweeping out and dusting, and 22 cents for double truck cars; the cost was formerly from 40 to 60 cents for the same cars. The percentage of cars housed for repairs averages about 10 per cent. of the number on his road. In answer to a question by Mr. Harrington, Mr. Van der Veer said that in Brooklyn the average is 10 per cent. on some lines and on others as low as 4 per cent. With single-truck equipments the percentage is higher than with double-truck equipments.

Mr. E. C. Foster, of Lynn, asked for information as to economy in operating a single motor on an ordinary car. His experience was that it is not profitable to operate such cars, on account of the increased expenses incurred in maintenance as compared with double-motor cars. He referred to a case of a double-motor car of 104-hp which, during the past season, has made 120 miles a day without any repairs during the entire summer.

Mr. Harrington said that his company having used a double-equipment car for a year, the results were so satisfactory as compared with single-motor equipments, that it had concluded to order a large number.

Mr. Connette said that in Nashville, where it is very hilly, an experiment was tried in running a single-motor car, and it was found by test that it used about 35 per cent. less power than a double equipment, but did not furnish sufficient tractive power. In Louisville there are 200 or 300 cars, nearly all of them run with one motor only, and they operate very satisfactorily.

Mr. Douglass, of Cleveland, said that the question of single and double-motor truck cars was largely dependent upon the condition of the track. With tracks in good condition he does not think that single-truck cars should be discarded. His company has a contract with an outside firm for making armature coils and doing similar classes of work, which is entirely satisfactory. He believed it to be economical for a large road to establish a brass foundry in order to make its own trolley wheels.

Mr. Beggs said he did not believe any road can afford to put in a brass foundry to make its own trolley wheels if they can buy them, as his road does, at 23 cents per pound for a finished wheel, the wheel weighing about 3½ pounds. He did not believe that any road could operate a foundry and turn them out at this price, which was given on a contract for 5000 wheels. Mr. Beggs expressed the opinion that no road can judiciously run single motors, and he has so believed for the past ten years. The saving of power referred to by Mr. Connette is, he thinks, threefold overbalanced in greater cost for repairs to single motors and other portions of the car. His company has contracted for thirty cars, on which there will be four motors, one to each axle; ten cars of this type were put on eighteen months ago, and it has been found that they cost less for maintenance than cars with double equipment, the number of cars in the shop averaging only 2 per cent. While the four-motor equipment requires possibly 30 per cent. more power than two-motor equipments, yet they admit of higher speeds, save money in wear and tear on equipment and give much more satisfactory service to the public; the number of flat wheels is greatly reduced, and the cost of maintenance on a four-motor equipment is 25 per cent. less than on a two-motor equipment.

Mr. Connette said that he did not mean to advocate a single-motor equipment, but for small cars where the streets are comparatively level and where the power of the motor is in proportion to the size of the car, it can be operated for less expense than a double-motor equipment. Some tests have shown a saving over double-motor equipments of 50 cents per car per day, and it will not cost as much to maintain one motor, even with a little extra service, as it does to maintain two motors.

Mr. Beggs said that on certain portions of the line between Milwaukee and Waukesha a speed of anywhere from 30 to 50 miles an hour was reached, the line having a private right of way.

Mr. Lang stated that his company, which also operated an electric light plant, maintained its own brass foundry and found it to be profitable. His company had just adopted a method of splicing two 16-foot car bodies together for use on double trucks. These cars, with new sills and proper bracing, can be utilized for a long time, the reconstruction costing in the neighborhood of $300.

Mr. Dimmock, of Council Bluffs, said that his company has spliced 16-foot cars to make a 42-foot car over all, including vestibules, and had been running them for five years with much satisfaction. The cost of splicing was between $300 and $400.

Mr. Beggs said that his company had decided that it was not economical to splice old car bodies for the reason that by the time double trucks were placed under the car, its cost was fully half the cost of the best car that can be built.

Mr. Dimmock said that in splicing the cars a steel frame was put around the bottom with truss rods, longitudinal seats being fitted.

Mr. Beggs stated that his company finds the mileage of the trolley wheels to be from 8000 to 9000 miles, and he knows of roads that get as high as 17,000 miles. The wheel is made of a composition of 86 per cent. of copper, 8 or 9 per cent. of tin, and 4 or 5 per cent. of zinc. The wheel wears rather more than the trolley wire, but it costs less to have the wear come on the trolley wheel than on the wire.

CURRENT NEWS AND NOTES.

TELEGRAPH IN MEXICO.—The federal telegraph system of Mexico, which is controlled by the government, is being rapidly extended, and already many of the small mining camps in the Sierras are in telegraphic communication with the rest of the world.

WIRELESS TELEGRAPHY IN CUBA.—It is stated that the government is negotiating with Mr. Marconi for the adoption of his system of wireless telegraphy between Key West and Havana. It is also proposed to establish communication in like manner between the eastern end of Cuba and the western end of Hayti. Lieut. G. O. Squier, of the Signal Corps, has charge of the matter in the interest of the government, and he is now in consultation with Mr. Marconi.

TELEGRAPH RATES IN SOUTH CAROLINA.—The threatened suits against the Western Union by the State Railroad Commission, which has the power to fix rates, has, according to a despatch from Columbia, S. C., been obviated by an agreement, after several months of legal sparring. The commission reduced the rates to 24 cents to make the company pay the revenue stamp. A compromise has been effected by leaving the 25-cent rate as it was and reducing the rates that were 40 cents to 25 cents, so that all points within the state have the same rates for telegraphic despatches.

NIAGARA FALLS.—The Commissioners of the New York State Reservation, in their fifteenth annual report, refer to Niagara as a great producer of power, which in the development of manufacturing and electrical industries is not likely to be neglected. In order to insure an undiminished flow of water over the falls the Commissioners deem it advisable that the national government be requested to appoint a commission to confer with a Canadian Commission as to the means to be devised to prevent any excessive diversion of the waters of the Great Lakes, and to consider the whole subject of the uses and control of these waters, and to report its conclusions to Congress, with such recommendations as it may desire to submit.

GERMICIDE ATTACHMENT FOR TELEPHONES.—Two patents were issued Oct. 17 for antiseptic or germicide attachments for telephones, one to Albert E. Woolf, of New York, and the other to George W. Van Alstine, Los Angeles, Cal. The former consists of a removable cover for the telephone mouthpiece, having applied to its inner side a receptacle for a germicide. When the telephone is in use this receptacle is removed from the opening of the mouthpiece, being replaced after a telephonic conversation. The Van Alstine invention consists in the use of a lining for a telephone mouthpiece, consisting of a detachable cup formed of an antiseptic gauze known to the trade as "Bichromid" gauze. It is claimed that this antiseptic gauze cup prevents the retention of any living germs, such germs being destroyed by the antiseptic contained in the gauze.

AN INTERESTING RAILWAY.—The Benbrook & Newry Electric Railway, in Ireland, is three miles long, and has a rise of 180 feet. All of the trains are mixed, i. e., passenger and freight cars combined. The passenger line is built of ordinary steel rails, outside of and adjoining which is a lower line of steel rails. The freight wagons, without flanges on the wheels, run on the lower outside rails; the inner rails for the cars are high enough above the outer rail to act as a guide to the wagons, keeping them on the track. At either end of the line the wagons are detached from the train and taken to their destination over the streets and roads by horses. There are no terminal charges, so the cost of handling is light. There is no delay or difficulty in getting the wagons on or off the ends of the line. The cost of the road, including land and all, was about $77,860.

ELECTRICITY IN COAL MINING.—Chief Mine Inspector R. M. Hazeltine, of Ohio, has issued his annual report for the year 1898, from which we learn that of a total amount of 14,058,135 tons of coal mined in the State of Ohio during 1898, 5,252,598 tons were mined by machinery, a gain of 1,147,474 tons over the preceding year. This increase equals the entire amount of machine-mined coal during the year 1890. Of the mining machines in use, 194 are operated by electricity as compared with 166 in 1897 and 59 in 1882. Fifty-eight were operated by compressed air, as compared with 67 in 1897 and 112 in 1894. The above figures not only show the great progress in electric mining machinery, but also indicate that it is displacing compressed-air machines. For coal haulage 12 electric locomotives were installed during the year, making the total number now in use in the State 22.

BELGIAN VEHICLE REGULATIONS.—The various accidents which have caused so much popular and press agitation in Brussels, Belgium, have resulted in a legislation on the subject of carriages, bicycles and automobiles, says United States Consul Roosevelt, at Brussels. According to the rules now enforced, all self-propelled carriages, not bearing the regulation number of the province, must carry the owner's name and address. All automobiles and autocycles must carry, both in front and behind, a number large enough to be seen at a distance, and after sunset each number must be lighted by a lamp. All automobiles, autocycles and bicycles, without exception, must be provided with a brake. The maximum speed allowed is 30 kilometers (18.64 miles) an hour in the open country, and 12 kilometers (7.46 miles) an hour in towns; cyclists are strictly enjoined to keep their hands on the handles and their feet on the pedals while riding. Cyclists are allowed to choose their own alarm bell, but rubber-tired carriages must carry bells.

MILES OF TRADE EXHIBITS.—Some idea of the magnitude of the buildings of the National Export Exposition at Philadelphia and the convenient arrangement of exhibitors' booths and facilities for reaching every part of all the structures, is conveyed by the fact that in the main building there is a length of main aisles of over 11,000 feet, and a length in the cross aisles of 14,000 feet, so that one who has walked through all of the aisles of this building will have completed a journey of about five miles. In the other buildings of the exposition there are more than four miles of aisles. Hence, to obtain even a glimpse of everything in the exposition grounds the visitor must walk nearly ten miles. These aisles are lined with a succession of all that is best and most interesting in American manufactures. In the construction of the buildings there were used 3,242,000 pounds of structural steel, and this enormous mass of intricate work was erected within fifty days from the date upon which the contract was signed by the parties interested.

AUTOMOBILE MOTOR.—A patent was granted Oct. 17 to Henry William Headland, of London, England, on an electric motor for automobiles, winches or stationary machinery. The motor belongs to the class having the armature fixed on the shaft and the field magnets applied to a casing or frame rotating freely on the shaft in the opposite direction, bevel-toothed wheel gearing being arranged between the shaft and the casing. The bevel-toothed wheel gearing in the construction described is claimed to be such that the end strains caused by the bevel frame are confined within the structure, the arrangement, moreover, being such that the power may be taken off from the motor in various directions, at various angles and at different speeds, as desired. The driving shaft is transverse to the armature shaft, and has on it two concentric bevel gears. As shown, the smaller of these engages with a bevel wheel secured to the field frame, and the larger with a bevel gear on the armature shaft, the latter being of smaller diameter than the frame bevel gear.

SHIP AND SHORE TELEPHONY.—The London *Electrician* some weeks ago made note of the fact that ships lying in the harbor of Genoa could now be connected with the telephone system of the town. In a recent issue of the same journal it is stated that the Houston liner Hyades, lying in the Herculaneum Dock at Liverpool, which has been chartered by the English Government as a transport, was, at the request of its owners, connected by the National Telephone Company with the Houston Company's office by private wire. In addition to underground wires, there were some spare overhead wires not very far from the berth where this vessel was lying, which made it possible to connect her up in six hours. The last span was taken from a pole close to the berth, insulated wires being fixed on the mainmast and brought down into the steamer's cabin on to a portable set of instruments, and a 4½-inch relay bell was fixed outside so that calls could be heard on board. The installation was an unqualified success, and later the Mount Royal, in an adjoining dock, and a third steamer, the Devona, in the Herculaneum Dock, were joined up in a similar manner. While telephonic connection with ships thus appears to be a novelty abroad, for many years it has been an ordinary occurrence at Honolulu. For fifteen years or more a warship entering that harbor and desiring telephonic shore connection, has, with little delay, been connected to one of several cables laid for that purpose, and a telephonic outfit installed aboard.

KELVIN'S SUCCESSOR.—Professor Andrew Gray has been appointed to the Chair of Glasgow University, rendered vacant by the resignation of Lord Kelvin. Professor Gray was at one time assistant to Sir William Thomson in the university and is well known from his several treatises on electrical science.

GALVANI'S WORKS.—In an editorial reference in a recent issue, to the petition of the International Electrical Congress asking the Italian Government to undertake the publication of a complete edition of Volta's works, it was stated that the works of Galvani had been published in collected form by that government. This we find to be an error, the works having been collected and published by the Academy of Science of the Institute of Bologne, the date on the title page being 1841.

AMERICAN PACIFIC CABLE.—At last Thursday's session of the International Commercial Congress in Philadelphia, Gen. Alfred S. Hartwell, delegate from the Hawaiian Islands, spoke of the importance of a connection by cable between the islands of the Pacific and the United States, both from the commercial and military point of view. In his opinion it would be best for the government to operate the cable, or if it was operated by a private company it should only be under government supervision.

AMERICAN INSTITUTE ELECTRICAL SECTION.—The American Institute of the City of New York announces the institution of an electrical course open to all members of the Institute without charge, and to non-members for the fee of $15 per class year. The ground covered is to be such as "to place students of the course in a position to read intelligently the standard books and current technical literature on electricity, to converse with confidence and to appreciate those points of economy which will be of benefit to themselves and to their employers." The president of the Electrical Section is Prof. George F. Sever, of Columbia University. Other officers are Prof. W. H. Friedman, of Columbia; D. R. Lovejoy, and C. O. Mailloux.

SPEED INDICATOR.—A patent was issued Oct. 17 to Harold W. Buck, Schenectady, N. Y., on a speed indicator, the principal object of which is to indicate variations in angular shaft speed. It consists of a small electric generator provided with means for coupling to the rotating body, such as a shaft or wheel. The generator is provided with a constant magnetic field and has in its generating circuit a source of opposing e. m. f. With this arrangement the generator, when at its normal speed, will balance the opposing e. m. f., and the voltmeter will indicate this by pointing to zero scale. Any variation of speed, however, will cause a flow of current in one direction or the other in the circuit, the scale indicating the amount of deflection one way or the other, and thus showing speed variation.

REGULATING ELECTRIC RAILWAY MOTORS.—A patent granted Oct. 17 to Martin T. A. Kubierschky, of Berlin, Germany, describes a method of street railway motor operation which consists in supplying the armature of the motor when starting with a low e. m. f. and gradually increasing this until it becomes equal to the line voltage. When stopping, the e. m. f. counteracting the armature voltage is gradually lessened, thus enabling the armature to produce energy until just before stopping. The method involves the use of a storage battery. When the controller is at its off position, the several groups of the battery are connected in series between the trolley and ground, and are thus being charged. At the first controller position, the armature of the motor is closed upon a resistance, while its field is connected across one of the groups of the battery, which arrangement represents the braking arrangements of the motor when it is brought to rest, but has no function when the motor is being started. As the controller switch is turned, the resistance is cut out, and the armature connected in shunt to the field, which represents the first running position of the controller. A further movement of the controller switch causes the free end of the resistance to be connected across the adjacent group of battery cells, this connection being a transition step to the next position, in which the armature with the resistance in series is connected across two groups of battery cells, while the field remains connected as before. The next step consists in cutting out the resistance, and the subsequent steps are repetitions of the foregoing ones until the final position of the controller is reached, when the armature is connectd directly between the trolley and ground and receives the full line potential. In bringing the motor to rest, the same operations are gone through with, but in the reverse order. When on down grades, or under other conditions which cause the motor to act as a generator through the connections thus made possible, the potential opposed to that generated by the motor may always be rendered such as to cause the motor to feed back current through the storage batteries to the line. With this arrangement, however, from the time the motor is started from rest until the time when the controller is brought back to its off position, the field is being continually excited by the same group of storage cells, thus causing a considerable inequality between the charging and discharging of that group and of the remaining groups. To obviate this objection, use is made of a battery switch, the function of which is to cause the different groups of cells to be used in rotation to excite the motor field, the changes and connections being effected each time the controller is brought back to its off position.

NEW THOMSON METERS.—Two patents were issued Oct. 17 to Elihu Thomson, one on an indicating voltmeter and the other on an alternating-current watt-hour meter. The former consists of the usual arrangement of a cylindrical moving-coil system in a field formed by pole pieces secured to the poles of a permanent magnet, the peculiarity consisting in the means for opposing the torque of the armature coil. The faces of the pole pieces are grooved concentric with the armature shaft, and in the grooves are mounted semi-circular pieces of magnetic material termed by the inventor "auxiliary pole pieces." These pieces are so shaped as to project most near the upper field gap, gradually decreasing as the lower gap is approached. On the shaft of the moving-coil is mounted a small transverse piece of magnetic material which the inventor terms a "magnetic return strip" or "auxiliary armature." This is situated with its ends directly over but not touching the projecting ends of the pole pieces. While in the zero position this strip is close to the auxiliary pole piece, but as the coil and strip move away, the distance gradually increases. Thus the necessary restoring torque is furnished by the magnetic attraction between the circular pole pieces and the "return strip," the deflecting torque being furnished as usual by the mutual action of the magnet and the coil. It is stated that in ordinary commercial instruments the deflecting torque is dependent upon the strength of the magnet, while the restoring torque is independent thereof; the indication instruments are thus liable to err, both from any change in the strength of the magnets and from any change in the strength of the restoring torque. In the instrument described, springs or their equivalent are entirely done away with, thus removing one common source of error, while any change in the deflecting torque due to a change in the strength of the field magnets is balanced by a corresponding change in the restoring torque. It should be added that connection with the movable coil is established by means of flexible connections which are made so light as, so far as possible, to neither assist nor retard the movement of the coil; these connections thus do not in any way form the equivalent of the spring return so commonly found in measuring instruments. In the watt-hour meter there are on the same shaft two interconnected closed-circuit armatures, one moving in a series and the other in a shunt field, neither field influencing the other. The series field is also supplied with a starting coil just sufficient to counterbalance the friction of the meter and thus increase its accuracy on small loads, where friction is not negligible. An inductance is placed in series in the shunt field to displace the phase between the current in the shunt coil and that in the main circuit. The coils of the two armatures are wound in parallel planes, but are so interconnected that they are electrically displaced from one another; thus, the plane of one coil may be displaced from the plane of the other coil by an angle of 60 degrees. These windings are so interconnected as to form what might be called a "polyphase transmission between the armatures."

LETTERS TO THE EDITORS.

Railway Motor Rating.

To the Editors of Electrical World and Engineer:

Sirs:—I do not think that the editorial in the current number of your journal does justice to Mr. Lundie's suggestion in regard to the method of rating railway motors. This I think is simply due to a misunderstanding of Mr. Lundie's proposal.

The suggestion is to rate motors intended for intermittent service, such as railway service, on a basis of the average electrical input regardless of the method in which the load varies, assuming always that the variation of load is so made that the temperature attains a constant value; that is to say, assuming that the motor is not allowed to cool down between applications of the load.

This suggestion has for its justification the fact, which seems to be borne out by an examination of a number of test records of railway motors of different sizes and makes, that the I^2R and core losses of a given motor are a constant percentage of the input at constant potential over a large range of input. If this is the case, it is obvious that there will be the same total energy spent in heating the motor whether a certain current is applied all the time or double the current for half the time. Your editorial assumes that the energy losses are constant in amount and not in percentage.

This suggestion to rate a motor on its average input obviously coincides with the present method of rating for continuous duty, since the rated load and the average load then coincide. Equally clearly it does not take into consideration the limitation fixed by commutation. This is a matter which must be considered separately. The present practice in rating railway motors is to specify a temperature elevation of 75 degrees C. for a continuous run of one hour. The rules of the American Institute of Electrical Engineers specify a temperature rise of 50 degrees C. for an indeterminate period, the wording of the rule being as follows: "In apparatus intended for intermittent service, as railway motors, starting rheostats, etc., the rise of temperature should be measured after a shorter time, depending upon the nature of the service, and *should be specified.*" That is to say, this rule does not give any definite rating for motors for intermittent service. The question of the time was purposely left open since the conditions of service were so different that it was impossible to specify times in the different cases. You will see that as far as the suggestion to rate on an average load is applicable, the question of time is entirely eliminated, and the rating very much simplified.

Whether the sum of I^2R and core losses in motors other than railway motors is a sufficiently close approximation to a constant percentage of the input, is a matter that can only be determined after a careful examination of data of tests in each particular case. Probably a better way to put the matter would be that the range within which the sum of these losses is a practically constant percentage, would have to be determined separately for each class of motors. For railway motors it seems to be a fact that the sum is a constant percentage throughout the range of practical operation of the motors. It is not constant at very low loads or at very high loads, but this is a matter of no special consequence, since the motors are not expected to operate at either extreme.

This suggestion does not take into account the temperature of the field coils and armature of the motor separately. The temperature elevation is supposed to be measured by resistance, and is the average of the two. To guard the matter carefully, a clause should be added limiting the maximum temperature elevation in either part. The field and armature should be so designed that the temperature elevations of the two parts shall be the same for the load rated in accordance with this method, and the two elements should be separately designed so that neither will attain a dangerous temperature within the range of load permitted to the motor. It is clear that when the temperature of the two parts is not equal, one must be higher than the average, and the other lower.

Motors rated in this manner are rated on a basis of continuous duty with a given temperature elevation. Railway motors, and all motors intended for intermittent service, work on loads which are heavy overloads as compared with their load for continuous duty. Hence, the figure giving the rating of a railway motor in accordance with this suggestion, expressed in kilowatts, would be very low; a 100-hp motor would become approximately 30-kw. This would probably not be acceptable to the maker. To avoid this difficulty the motor might be given an arbitrary designation expressing the product of the current and the percentage of time for which the current could be applied. In the case cited by Mr. Lundie, the motor might be called A-B 6000, meaning that it would take 100 amperes for 60 per cent. of the time, 250 amperes for 24 per cent. of the time, or any intermediate values of which the product is 6000; the limits between which the sum of the two losses is a constant, in this case being 100 and 250 amperes.

This matter, I think, is deserving of consideration, as it seems to offer a more satisfactory method of rating motors for intermittent work than any I know of. I hope that engineers having access to data bearing upon the validity of the fundamental assumption will make suggestions concerning it.

NEW YORK, N. Y. CARY T. HUTCHINSON.

Professional Degrees.

To the Editors of Electrical World and Engineer:

Sirs:—Referring to the letter of Mr. Rimanoczy in your issue of Oct. 21, to the first question asked—Should the M. E., C. E. or E. E. degrees be conferred after four years of undergraduate work?—I have no hesitation in answering No! To the second—the time to be spent in engineering work before becoming eligible to a degree—I would reply that two full years of special study should be given to the matters pertaining to electrical science and its applications after a *complete undergraduate college course in which mathematical* studies have been made very prominent, before the degree of E. E. should be given, no matter what time has been spent in engineering work. To the third question—Should a thesis be required for a degree?—I reply, Yes. To the fourth (which I assume relates to a four years' course), I reply, Not very highly. To the last, I reply that reputable medical colleges demand a college course as a condition of entrance, and at least three full years of work at professional study before the degree of M. D. can be given. There should be greater maturity and proficiency than could reasonably be expected of the electrical engineer, whose course of study has not been nearly commensurate in point of time. Yours truly,

PRINCETON, N. J. C. F. BRACKETT.

To the Editors of Electrical World and Engineer:

Sirs:—Answering the questions of Mr. Rimanoczy regarding professional degrees, I do not hesitate to say that M. E., C. E. or E. E. may be granted after four years of undergraduate work. In that time good students can be made sufficiently familiar with any one branch of engineering that they are competent to take it up and do useful work in it after a very little practical experience "to break them in." It is also a fact that another year of college work would not save or even materially shorten this probationary period. At the end of four years most of the graduates do actually know nearly all of the principles and applications of their profession. In fact, their knowledge is much more general than that of the average practicing engineer, and greater than their own will be after they have been out in practical life for several years.

In a first-class institution they can, and generally do, get the essence of the experience and study of many teachers, each a specialist in his own line, and presumably himself the equal intellectually of the ordinary practitioner.

The notion that such a man should not be given a degree as an engineer is probably due to the fact that he lacks business experience and a certain facility in using trade methods and terms which it is impossible and probably undesirable for the college to give him except in a general way. He also lacks an intimate knowledge of some one part of his profession, such as arc lamps, telephone switchboards or storage batteries. But he understands all these things, and in the course of from one to three months ought to acquire a fair degree of off-hand familiarity with any one line of practical work.

Of course, a graduation thesis should be required, and it ought to be made as much as possible a test of a man's ability to do independent work of an important character. Subjects which actually arise in practice should be selected. I have often withheld degrees from men who had complied with all the four years' requirements, but had not produced a sufficiently good and original thesis.

The custom in many schools of giving the engineer degree one or more years after the student leaves college with a B. S. or Ph. B., does not strike me as any improvement over the other plan. Who is to determine whether a man has done well in outside work, and how is it to be decided by the authorities in the college? It gives opportunities for both favoritism and jealousy to magnify or decry a man's merits. Furthermore, the success achieved is a possession of the man which does not have to be given or confirmed by his college. What he wants is a *start.* FRANCIS B. CROCKER.

COLUMBIA UNIVERSITY, NEW YORK.

To the Editors of Electrical World and Engineer:

Sirs:—To properly answer the several questions in Mr. Rimanoczy's letter, which seems to have a general interest, more space would be required than is allowable in this column. I shall there-

fore confine myself as closely as possible to categorical answers.

(1) The degrees M. E., C. E. and E. E. were, of course, originally intended to mean more than the mere fact that their possessors had graduated in the respective college courses, which they now indicate. This is a fact, but whether it ought or ought not to be so, is a matter of opinion depending on the point of view. If one takes the view that these branches of engineering are dignified professions, and that the degrees should be in a measure indices of professional standing, then it is obvious that this object is defeated by the graduating degrees. If, on the other hand, the degrees are regarded as mere certificates of graduation they may be defended on that score.

(2) As to the time to be spent in engineering work before becoming eligible for a degree, this question seems open to debate, but in the writer's opinion five years after graduation is soon enough, if it be intended to do away with the graduating degree principle.

(3) As to the requirement of a thesis for a degree, this would not appear a necessity, but it might be one of the means of securing the desired degree.

(4) Sensible persons, both within and without the engineering profession, regard the degrees mentioned as mere certificates of graduation.

To the last question—whether engineering degrees are as legitimate as a medical one—I think it safe to answer that at present medical graduates have enough undergraduate hospital practice to place them ahead of engineering students in general, though perhaps not in all cases.

Townsend Wolcott.

New York, N. Y.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

Dynamos, Motors and Transformers.

Unipolar Motor.—Eichhorn.—After criticising unfavorably the editorial on "wasted effort" in the Elec. World and Eng., Sept. 9, he gives a brief illustrated description, taken apparently from a patent, of a motor which he invented, which is based on the principle of the so-called unipolar machines. An illustration and a brief description are given. In principle it is merely a series of unipolar machines, each one forming what he calls a section and taking about 22 volts; these sections all drive one shaft and may be connected electrically in series, parallel, or grouped otherwise; he therefore claims that it is suitable for automobiles. Each one is a unipolar machine of the well-known Forbes type, the armature being a disc revolving between two annular poles and the current being led off at the periphery and near the centre; this is done by small spirals of phosphor bronze, which presumably roll like rollers in a bearing; the armatures are of laminated iron with the radial windings cast into them; the speed is about 4000 revolutions per minute; a motor of ¾-hp seems to contain five sections. The chief claims are low cost of manufacture, one-quarter of the weight, wide variations of speed, etc. He does not state that the motor has ever been introduced or that it has even been tried, although theoretically the principle is correct.—*West. Elec.,* Oct. 14.

Inductor Alternators.—Johnson.—A short article in favor of inductor alternators, pointing out that a two-coil inductor alternator overcomes the disadvantages of ineffective regulation and overheating through hysteresis, which are inherent in single-coil inductor alternators.—*Can. Elec. News,* October.

REFERENCES.

Friction Losses in Dynamos.—Dettmar.—A long French illustrated abstract of the article noticed in the Digest June 24 and July 8. —*L'Eclairage Elec.,* July 29.

An Early Alternator.—Brooks.—An illustrated description of a pair of early machines consisting of a Gramme exciter and a Gramme Jablochkoff alternator which were imported from Paris in 1879 to San Francisco.—*Jour. of El'ty,* September.

Lights and Lighting.

REFERENCES.

Costs of Lighting in San Francisco.—An abstract of the report of Hunt on the cost of a steam and electric plant for lighting the streets and municipal buildings of San Francisco, with specified estimates of the costs of a steam electric plant and distributing system, with the annual cost of operation, and that of 300 additional arc lights.—*Jour. of El'ty,* September.

Power.

Apparatus for Power Transmission in New York.—An illustrated description of the alternating current generators, rotary converters and transformers to be used by the Metropolitan Street Railway, New York. The generators are of the revolving field type, with external stationary armatures. Each machine has a capacity of 2500-kw, and will generate a three-phase current of 6600 volts at a frequency of 25 cycles per second and run at 75 revolutions per minute. The revolving field has 40 poles, and is mounted directly on the engine shaft. It is well ventilated. Each coil is tested with a alternating current of 25,000 volts. The armature is of cast-iron, and arranged with sliding foundation plates so that it can be moved to one side until clear of the revolving field, thus permitting access for inspection and repairs to both armature and field. The revolving field is composed of a steel ring, which is firmly bolted to a cast-iron frame which is keyed on the engine shaft. The step-down transformers at the rotary converter stations are of 250-kw each, and three are required to operate each rotary converter. The primary winding of the transformer is designed for 6000 volts, and the secondary for 300 volts. The transformers are cooled by an air blast and have an efficiency at full load of 98.22 per cent. The rotary transformers are of 990-kw each, and operate at 214 revolutions per minute. The field has eighteen poles made of cast iron. The armature winding is made of copper bars. The brushes on the alternating end of the rotary converter are of copper, and the rotary converter operates as a six-phase machine. The rotary converters are started from the direct current by means of current furnished by storage batteries.—*St. R'y Jour.,* October.

REFERENCES.

Driving Printing Machinery.—The advantages of electric motors are stated and some data for the power required for different forms and sizes, are given.—Lond. *Elec. Rev.,* Oct. 6.—Scholey.—A short abstract of a lecture on the same theme; it does not seem to contain anything new.—Lond. *Elec. Eng.,* Oct. 6.—(See also the abstract of the paper of Tapley, Digest, Oct. 21.)

Transmission and Distribution of Energy.—Leblanc.—The continuation of his long series. (Digest, Oct. 14.) He continues the discussion of redressing transformers.—*L'Eclairage Elec.,* Sept. 23 and 30.

Traction.

Railway Power Distribution Over Large Areas.—Armstrong.—A New York State St. R'y Assn. paper, stating that the recent consolidation of all the railways of Buffalo compelled the redistribution of the feeder system and the consolidation of the power stations. It was finally decided to operate all the lines from Niagara Falls, from which 7500-hp had been obtained up to that time. The present plans contemplate the construction of six substations having a converter output of 6000-kw, and ultimate capacity of 8000-kw, with the establishment at one station of a storage battery of 3000 ampere-hours capacity. To provide an efficient method for starting the rotary converter, all the substations have been equipped with a starting set consisting of an induction motor directly coupled to a direct-current generator of sufficient capacity to start one converter. This method permits the starting of the converter at one station from the direct current end of the generator, when converters in the adjacent substations can be started from the direct-current feeder system.—*St. R'y Jour.,* weekly, Sept. 23.

Polyphase Electric Traction.—A long editorial pointing out that the use of polyphase currents for traction has not found the same attention in the United States as abroad. Some lines in the west are considered where polyphase currents could be used to good advantage, such as between San Francisco and San José. The article of Prof. Jackson, noticed in the Digest Sept. 16, is abstracted, and

reference is made to the Heilmann locomotive which is a complete steam electric generating station on wheels, making electric power only for the purpose of supplying its own motors. Although this electric locomotive was built in 1895, no data concerning its performance have yet been available, but its builders calculated that a locomotive of this type having an output of 1500-hp would be capable of hauling a 50 per cent. greater trailing load at 50 per cent. higher speed than a steam locomotive of equal weight and engine capacity. —*Jour. of El'ty,* September.

The Performance of Railway Motors.—Potter.—A short article stating that the horse-power of the motors built by the General Electric Company is rated according to an arbitrary standard, based on a temporary rise of the temperature of the motor 75 degrees Cent. in one hour under full load, the temperature of the surrounding air being assumed to be 25° C. The motor cannot be operated at this rate of output continuously, but can be worked above this rating for short periods of time without injury. The average horse-power carried by a motor throughout the day should not be greater than 30 per cent. of the rating as given above. Where electric brakes are used the motor should be from 20 to 25 per cent. greater capacity than where they are not used. Under ordinary conditions the horse-power required in motors should be the total weight in tons multiplied by the maximum speed in miles per hour on a level, and divided by 5. If the maximum speed is not known, it can be taken as twice the schedule speed. This rule should be, however, applied cautiously, and only indicates the minimum capacity under ordinary conditions. In ordinary street service the tractive effort during acceleration is between 10 per cent. and 13 per cent. of the load carried. In elevated or suburban service it is generally from 5 to 7½ per cent.; while in freight work, where slow speeds are used, it may not exceed 1½ to 2 per cent. In ordinary service the weight on the traveling wheels should be at least six times the tractive effort required. The approximate capacity of a power station for any given service is about 100 watt-hours per ton-mile at ordinary speeds.—*St. R'y Jour.*, October.

New Type of Street Railway Motors.—An illustrated description of five types of motors recently put on the market by the Westinghouse Company, and varying in size from 30-hp to 130-hp. The first two described are so arranged that by removing four bolts, and disconnecting the springs suspending it, the entire motor can be removed from below the car by a screw-jack running in a pit. A car equipped with these motors usually changes motors every other day, allowing for careful inspection. They are fitted for either grease or oil lubrication, and the oil is fed in between the gears where the pressure is least. The third motor is designed to be inspected while on the car, and not frequently dismounted; it is composed of two parts hinged in the centre; by unscrewing a bolt the lower half can be swung down into a pit, and the armature can be retained in either the upper or lower half, as desired. The fourth and fifth motor are designed for heavy work, and are of 110 to 150-hp capacity each. They are designed to be mounted on trucks which can be run out under the car, and the upper half of the motor can then be removed. All the motors are dustproof and shed water, and are provided with laminated pole pieces, which are bolted to the yokes instead of being cast into the yokes.—*St. R'y Jour.*, October.

Electro-Pneumatic System of Motor Control.—An illustrated description of this system used in Pittsburg, where two or more motor cars are made up into a train, and each car has its own controller, making it necessary for the controllers to be moved in exact synchronism, in order to have all the motors run at the same speed. The operation of all the controllers is directed from the front platform of the first car, and is accomplished by air power. On the top of each controller are two air cylinders, one of which carries a pawl, which engages with a ratchet wheel on the top of the controller. The air cylinders are operated in unison by a small electric battery operated by a small electric switch in the front cab. The second air cylinder is for returning the controller to the ° position, and is also operated by the motorman on the front platform. The circuit breaker is so arranged that it will throw the controllers to the off position in case it should open. If the air-brakes are applied all the controllers return automatically to the off position. The air compressor which is illustrated is also of a novel type, and consists of a compound rotary pump directly driven by a small motor. In the trucks used the spring support for the motors is kept entirely distinct from the spring support of the cars.—*St. R'y Jour.*, October; *R. R. Gaz.*, Oct. 13.

Air-Electric System.—Merrick.—A short illustrated description of his air-electric system, in which compressed air is used to propel the car, and electric power is used in motors on the car to compress the air. The disadvantage that about 25 per cent. of the electric power is lost in compressing the air, is claimed to be counterbalanced by the advantages gained in using compressed air, namely, in reducing the great wear and tear of the electric motor, and to permit of a simple and effective method of starting and stopping, there being only one controller crank used instead of two, to start the car and to "change the motors to compressors" and operate the brake.—*St. R'y Rev.*, October.

Oshkosh Three-Phase Electric Railway.—An illustrated description of the interurban three-phase, single-track line of 16 miles between Oshkosh and Neenah, Wis. The urban lines in Oshkosh, aggregating 16 miles of single track, are operated on the continuous current system. There are three generators, two each of 225-kw, giving continuous current at 550 volts; the third is a 6600 volt, three-phase revolving field machine of 300-kw. The three-phase current is led to six 50-kw air-blast transformers, three being at the power house and three at the substation on the interurban line, 12 miles distant. The power house and the substation each also contain a four-pole synchronous converter of 150-kw.—*St. R'y Rev.*, October.

Santa Clara.—Bean.—An illustrated description of the plant of the First Street Electric Railway Company in Santa Clara, Cal., which is said to be typical of most of the electric railway plants in the small cities of the west. The generators, originally installed in 1890, are two of the D 62 type of Thomson-Houston, for 120-amp. at 500 nominal volts. The next machine, installed in 1893, is one of the M P 100 railway generators of the General Electric Co. A storage battery does not seem to be used.—*Jour. of El'ty,* September.

Experiments on Rail Bonds.—An article pointing out the necessity of providing a good return circuit and then recommending frequent tests of the bonds. To obtain actual resistances is a long process, but quick tests can be made which will indicate whether any one bond is of very high resistance by traveling over the system with a car equipped with contact devices and making voltmeter readings as joints are passed over. The writer gives some sample tests of joints.—*St. R'y Jour.*, weekly, Sept. 23.

Double Motors, or Compensating Gears for Automobiles.—Hanchett.—Some illustrated comments on current practice. In an automobile with two driving wheels on the same shaft, it is necessary to provide means for these wheels to turn independently of each other in order that the vehicle can turn corners and otherwise be readily steered. With a single motor this is accomplished by connecting the two wheels together through an epicyclic nest of bevel gears; with two motors each driving wheel can be sleeved on the shaft which is then stationary, and one motor can be geared to each driving wheel. The necessary subdividing and sleeving of the driving shaft and the casing of the compensating gear, make the cost of the single-motor vehicle fully equal to that of one with two motors. When the motors are independent of each other, such as is the case of two shunt-wound motors with independent connection to the source of supply, the system is somewhat analogous to the case of two rigidly connected wheels driven by a single motor, the steering is stiff. The two electric motors, however, afford advantages in control, and they may be connected in other ways in which the stiffness of steering is done away with. The series parallel control has the same advantages for automobiles as for tramways; moreover, in automobiles the cells of the battery can be connected in series or parallel; the series parallel control, however, is covered by a patent With series motors the parallel connection does not entail nearly as great a stiffness of steering as with shunt motors. If two shunt motors are connected in series, the stopping of one of the wheels makes the other revolve at double speed, which action is precisely analogous to that in the case of a single motor driving two wheels with compensating gears; the steering is very easy.—*The Automobile*, October.

Cost of Operation of a Cab Per Day.—Forestier.—An abstract of a paper read before the French Society of Civil Engineers, giving the results of a recent competition of cabs in Paris and calculating the cost of the daily trips of a cab. His calculation is based on the supposition that the distance per day is 37 miles, 28 miles on the trips themselves and 9 to and from the depot. He arrives at the same figures as last year, namely, $1.28 for the average consumption of electrical energy and $3.97 for the average total cost of an electric cab per day, which number exceeds the cost of a horse-driven cab by only ten cents. He found, however, that there was a very slight diminution of the consumption of electric energy per cab-mile. The gasoline automobiles which took part in the competition this year.

consumed much less gasoline than last year; the consumption, however, is still too large to compete economically with electric cabs.—*L'Eclairage Elec.*, July 29.

Canal Traction With Storage Batteries.—A note stating that the executive committee of the Erie Canal electric traction company has adopted the storage battery system for use as its motive power. A traction engine will run along the towpath, drawing a boat filled with storage batteries carrying sufficient energy for drawing behind the battery boat a reasonable number of boats with cargoes. No further information is given.—*Elec. Rev.*, Oct. 11.

REFERENCES.

Electric Railway Practice in Great Britain.—SHORT.—An illustrated article describing many of the principal peculiarities of British practice, and explaining the difficulties which have attended the development of the industry in that country up to the present time, owing to the restrictions imposed by Parliamentary action and to the growing desire for municipal ownership as against private enterprise. The technical details of roadbed, overhead construction, rolling stock, etc., are well illustrated and described.—*St. R'y Jour.*, October.

Financial Characteristics of the Large City Railway Systems of the World.—HIGGINS.—A compilation of the statistics of mileage, investment, receipts and expenses of railway systems in cities of over 500,000 inhabitants in all countries of the world, arranged in such a way as to show comparative profits and opportunities for investment.—*St. R'y Jour.*, October.

Chicago.—A profusely illustrated article on the plant of the Metropolitan Elevated Railway, which has been greatly enlarged this year.—*West. Elec.*, Oct. 21.

Chicago and Milwaukee.—An illustrated description of this electric railway.—*West. Elec.*, Oct. 21.

Toledo, Fremont and Norwalk.—A short description of this road, which is 60 miles in length, and is now being built. Power is being distributed by the three-phase system at 15,000 volts changed to direct current on the line.—*St. R'y Jour.*, October.

Machine for Tearing Up Old Rails.—An illustrated description of this machine, which can tear up about two miles of track a day, and breaks the rails in any length, usually from 4 to 8 feet.—*St. R'y Jour.*, October.

Automobiles.—FELDMANN.—A long illustrated German abstract of the article on electric automobiles at the second International Exposition of the Automobile Club of France, noticed in the Digest Aug. 12.—*Elek. Zeit.*, Oct. 5.

Automobile Fire Pump.—A brief illustrated description of the one used in Paris, already referred to a number of times in the Digest.—*L'Eclairage Elec.*, Sept. 23.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Carlisle.—A long illustrated description of this English municipal lighting and traction plant. There are two steam dynamos, each of 200 indicated horse-power, which are provided with series over-compounding coils for tramway working. They are rated at 255 amperes, 490 volts, at 330 revolutions per minute when running shunt, and 550 volts, 277 amperes, at 350 revolutions, when compound, the increased pressure in the latter case being obtained partly by increased armature flux and partly by increased speed. There are also two smaller sets, each consisting of two dynamos coupled to a single engine, all four dynamos being rated at 116 to 131 amperes and 230 to 260 volts, at 460 revolutions, and a battery of 250 chloride cells of a normal capacity of 300 ampere hours, with a maximum discharge rate of 120 amperes for half an hour.—Lond. *Elec. Rev.*, Oct. 6.

Alderley Edge Lighting Plant.—An illustrated description of the lighting plant in this small English village. The three-wire system, with 420 volts between the outers, is used. The current is supplied by two 70-hp dynamos and a storage battery of 230 cells, having a capacity of 585 or 438 or 392 ampere hours, respectively, when discharged at 65 amperes in 9 hours or at 75 amperes in 6 hours, or at 98 amperes in 4 hours. The cells are said to embody all the most recent improvements in storage batteries, of which the most important is said to be the one-half inch spacing between the plates, whereby short circuiting by means of particles bridging across from plate to plate, is no longer possible.—Lond. *Elec. Eng.*, Oct. 6.

Promontor.—PICK.—A long illustrated description of this electric light and power plant in the wine district of Hungaria. There are two continuous current shunt wound dynamos of 50-kw at 300 to 480 volts, and a storage battery containing 56 cells, each of 165 or 234 ampere hours if discharged in one or three hours, and 130 cells, each of 99 or 135 ampere hours, if discharged in three or ten hours. For operating the pumps in the wine cellars, small motors of ½-hp are used.—*Zeit. fuer Elek.*, Oct. 1.

REFERENCES.

Switches.—BAXTER.—The first part of a well illustrated article of a general nature on the construction of electric switches. Single-throw and double-throw, single-pole and double-pole, single-break and double-break switches, various methods of insulating the blades on two or more poles switches, and some types of quick-break switches are described and illustrated.—*Amer. Mach.*, Oct. 12.

Power Station Economies.—HOOPS.—The first of a series of articles, in the present one of which he gives brief hints concerning the measurement of the fuel, water, etc., for the boilers.—*Elec. Rev.*, Oct. 11.

WIRES, WIRING AND CONDUITS.

Electric Wiring.—ANDREWS.—The first part of what may be a long illustrated serial on electric wiring system. The present part deals with the insulation, protection, joints, etc. He assumes that the most effective methods of protecting the insulated conductors are armoring with lead or with iron wires and conduits or tubes; in the concentric system of wiring there are to be found features of conspicuous superiority in all respects, to those obtained in any modification of twin wiring, and the concentric system is not confined to the appliances of twin wiring. Soldering is the only effectual means of uniting metals for electrical purposes. He has adopted porcelain in the joints to replace the insulation round the soldered junction. The concentric joint and the joint for wiring are described and illustrated, also outlets for the concentric system.—Lond. *Elec. Rev.*, Oct. 6.

ELECTRO-PHYSICS AND MAGNETISM.

Electric Waves.—LEBON.—A discussion of the transparency to Hertzian waves, showing that metals are not nearly as opaque as was at first thought, but he finds that if the enclosure of the apparatus be perfect the waves do not get through; apparent transparency is due to the waves getting through cracks or around the metal; if there are no cracks a thickness of 1-mm. is as effectually opaque as 2-mm., and forms a perfect screen so that waves cannot even travel down a metallic rod into the interior of a perfectly closed box; a chink is much more effective in allowing Röntgen rays to pass through than a much more considerable series of apertures; metallic gauze is very nearly as opaque as a plate.—*Revue Scientifique*, 11, p. 513.

GUTTON.—An Academy paper on the velocity of electric waves along wires compared with that in the air; within the limits of error of observation, which were about 1 in 200, the two velocities appear the same.—*Comptes Rendus*, June 19.

KAUFFMANN.—A discussion of abnormal absorption and of luminescence of vapors under the influence of Tesla waves.—*Zeit. Phys. Chem.*, 28, p. 673.

All the above are abstracted in *Science Abstracts*, October, including also a mention of the paper of M'Lean in *Phil. Mag.*, July, on the velocity of electric waves, in which he found it to be about 186,365 miles per second in air for waves 6 meters long.

Spectrum of Discharges.—HAMY.—An account of experiments which do not agree with the statement of Perot and Fabry that the spectrum of discharges through a tube containing vapors of cadmium is different with and without a condenser in parellel with the discharge circuit, the source of current being a Rhumkorff coil. He found the spectrum to be identical in both cases.—*L'Eclairage Elec.*, July 29.

Electrolytic Action Near Crookes Tubes.—BRODIER and SALVADOR.—An investigation to explain the effects of Crookes tube discharges on the skin, which are generally attributed to Roentgen-rays. They found a marked electrolytic effect and they attribute the effects on the skin to these electrolytic actions.—*Comptes Rendus*, June 19; abstracted briefly in *Science Abstracts*, Oct.

Dielectro-Magnetic Media.—BOCARA and PANDOLFI.—A discussion of this material made of chemically pure iron in the form of an impalpable powder, mixed with paraffine. When the percentage of weight of the iron is over 50, the material becomes conducting, and the measurements are, therefore, confined to lower percentages. The inductivity is shown to increase more and more rapidly with the percentage of iron.—*Nuovo Cimento*, 9, p. 254; abstracted briefly in *Science Abstracts*, Oct.

Atomic Magnetism.—MEYER.—A continuation of his researches,

noticed in the Digest, Aug. 5. He extended his magnetic investigation to some 200 inorganic compounds of all the known elements. He found that the combination of two diamagnetic elements is always itself diamagnetic; compounds consisting of paramagnetic elements are, however, not necessarily paramagnetic. It is not permissible to predict the magnetic quality of an atom from that of the molecule of which it forms a part. He discovered quite a series of strongly magnetic elements, represented by the symbols, Pr, Nd, Yb, Sa, Gd and Er. The oxide of erbium has four times the permeability of ferric oxide; if it is found that the metal is more strongly magnetic in the same proportion as its oxide, a very important addition to our magnetic resources will have been made, for since the specific gravity of metallic erbium is only two-thirds of that of iron, it would then be possible to construct dynamos of only one-sixth of their present weight, but metallic erbium has not yet been found in reasonably large quantities. As a rule the molecular magnetism of paramagnetic compounds is smaller than the sum of the atomic magnetisms. In diamagnetic compounds the magnetic qualities are simply additive. Valuable conclusions as to its molecular weight may be drawn from the magnetism of an element.—*Wied. Ann.*, No. 9; abstracted in Lond. *Elec.*, Oct. 6.—A brief abstract, in French, of his first article, with a full page table of values, is given in *L'Eclairage Elec.*, Sept. 30.—His former paper is also abstracted briefly in *Science Abstracts*, Oct.

REFERENCES.

Electrification of Nascent Gas.—KOESTERS.—An account of experiments made to study the electrification of gases evolved by electrolysis. He passed several such gases in the nascent state through liquids, and determined the power thus acquired of producing an electrometer deflection.—*Wied. Ann.*, No. 9; abstracted in Lond. *Elec.*, Oct. 6.

Thorium Radiation.—OWENS.—An account of a long experimental investigation of the radiations emitted by thorium and its salts. He studied the conditions affecting the constancy of the radiation; the relation between current and e. m. f.; the comparative radiations from different salts; the two types of radiation; selective absorption; the effect of suspended particles in the path of the conduction-current; the variation of conduction current with the pressure of gas; and the absorption of radiations in air.—*Phil. Mag.*, Oct.

Transformation of X-Rays.—MALAGOLI and BONACINI.—An article on the transformation of such rays by materials, in the nature of a discussion with Sagnac, who has written so much on this subject; they do not seem to agree with him.—*L'Eclairage Elec.*, Sept. 30.

High Rate Roentgen Tube.—An illustration with brief description of a slight modification of the tube described in the Digest, Oct. 14.—Lond. *Elec. and Elec. Rev.*, Oct. 6.

Roentgen Radiation.—HILLERS.—A series of carefully made experiments on currents traversing Röntgenized gases and the effect of the pressure of the gas on the current.—*Wied. Ann.*, 68, p. 196; abstracted briefly in *Science Abstracts*, Oct.

NEESEN.—He shows that the onset of Roentgen radiation is simultaneous with the development of a retarding force which brings to rest a rotating electrode consisting of a pair of vanes having metal on one side and mica on the other.—*Ver. Deutsch. Phys. Gesell*, 1, p. 69; noticed briefly in *Science Abstracts*, Oct.

Cathode Rays.—WEHNELT.—A long illustrated French abstract of the article noticed in the Digest, Aug. 19.—*L'Eclairage Elec.*, Sept. 30.

Polarizing Effect of an Opening on Hertzian Waves.—WAITZ.—A French abstract of the article mentioned in the Digest, Dec. 3, 1898.—*L'Eclairage Elec.*, Sept. 2.

Spark Discharges.—ALMY.—An account of experiments made with spark discharges in solid and liquid dielectrics. The relation between the discharge and the thickness of the dielectrics can be expressed by a linear equation.—*Verh. Deutsch. Phys. Ges.*, 1, p. 95; abstracted in *Science Abstracts*, Sept.

Polarization of Dielectrics.—PELLAT and LIENARD.—Abstracts of three papers read before the French Academy. The second paper of Pellat, in which he formulates a new law concerning the polarization of dielectrics in electric fields, was noticed in the Digest, July 15.—*L'Eclairage Elec.*, Sept. 23.

Theory of Dielectrics.—BEAULARD.—The paper noticed in the Digest, Sept. 9.—*L'Eclairage Elec.*, Sept. 23.

Electric Deformation of Dielectrics.—SACERDOTE.—The French Academy paper abstracted in the Digest, Oct. 7.—*L'Eclairage Elec.*, Sept. 23.

Electrolytic Thermopiles.—DUANE.—A long French abstract of the article noticed in the Digest, Sept. 10 and Dec. 24, 1898.—*L'Eclairage Elec.*, Sept. 23.

Progress of Science and Its Results.—FOSTER.—The first part of a reprint of his Brit. Ass'n address mentioned in the Digest, Oct. 7.—*Sc. Amer. Sup.*, Oct. 21.

Magneto-Optic Phenomena.—Abstracts of four articles; one on the correlation of the Zeeman effect by CORBINO, from the *Roma R. Accad. Lencei Atti*, 8, p. 250; another on the theory of the Zeeman effect by VOIGT, from the *Wied. Ann.*, 68, p. 352; another on magneto-optic phenomena by PRESTON, in *Nature*, June 22, which is a reprint of a Royal Institution lecture of May 12; another on the same subject by DRUDE, from the *Ver. Deutsch. Phys. Gesell*, 1, p. 107, which is a systematic development of the equations.—*Science Abstracts*, Oct.

Magnetic Hysteresis of Cobalt.—FLEMING, ASHTON and TOMLINSON.—A long abstract with tables of the Physical Society paper noticed in the Digest, Sept. 30.—Lond. *Elec.*, Oct. 6.

Magnetism.—SCHMIDT.—A long French abstract of his long serial of practical notes on magnetism for engineers, referred to in the Digest about a year ago.—*L'Eclairage Elec.*, July 29.

Magnetism at Very Low Temperatures.—OSMOND.—An abstract of the paper noticed in the Digest, Sept. 2.—*L'Eclairage Elec.*, July 29; *Science Abstracts*, Oct.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrolytic Perchlorates.—WINTELER.—Perchlorates can be formed by prolonged electrolysis of solutions of the alkali metal, or alkaline earth chlorides, if platinum electrodes are used, having only "one surface in contact with the electrolyte." After all the chloride has been converted into chlorate, the best conditions for further conversion into perchlorate are acidity and low temperature of the solution at the anode, a current of 4 to 12 amperes per square decimeter at the anode, and a saturated solution; 73 to 95 per cent. of the oxygen liberated at the anode may thus be fixed as perchlorate. The formation of perchlorate is accompanied by that of ozone. Perchloric acid can be formed in a similar manner by electrolysis of hydrochloric acid.—*Chem. Zeitung*, vol. 22, p. 90, 1898; *L'Ind. Electrochim.*, vol. 3, p. 3; abstracted in *Science Abstracts*, Sept.

Electrolytic Laboratory.—NISSENSON.—A well illustrated description of the electrolytic installation for chemical analyses in the laboratories of a company at Stolberg and in Westphalia. There are two dynamos and an accumulator giving 252 or 178 ampere hours respectively if discharged at 25 amperes in 10 hours, or at 60 amperes in three hours.—*Zeit. f. Elektrochemie*, Oct. 5.

Acetylene Gas Industry.—KERSHAW.—He calls attention to the progress of this industry, including some statistical data concerning the manufacturing companies and the progress in the utilization of the gas for lighting. He concludes that the industry is advancing, and that in certain directions there may be considerable development in its use, but that this is not likely to occur where coal gas and electricity are or can be introduced.—Lond. *Elec. Rev.*, Oct. 6.

REFERENCES.

Cost of Calcium Carbide.—LIEBETANZ.—A long abstract with some of the data of the article noticed in the Digest, Oct. 14.—*L'Eclairage Elec.*, Sept. 30.

Electrolysis of Chlorides of Alkalies.—WOHLWILL.—Critical remarks on some chemical questions in the paper of Foerster, noticed in the Digest, Aug. 5.—*Zeit. f. Elektrochemie*, Oct. 5.

Glycerine Baths.—MARINO.—A French abstract with some of the data of the article noticed in the Digest, Oct. 14.—*L'Eclairage Elec.*, Sept. 30.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Three Voltmeter Method for Measuring the Power of Alternating Currents.—NIETHAMMER.—An illustrated analytical discussion. The method seems to be practical in special cases, as the measurements of small powers with the ordinary electrodynamic wattmeter are rather inexact, and the results are dependent upon the phase difference and on the form of the wave. He finds that the three voltmeter method is theoretically independent of phase difference and wave form, it being assumed that the voltmeter and the amperemeter give the exact effective values, and that the auxiliary resistance is entirely without induction. Practically, however, the three voltmeter method has many disadvantages; it is very complicated on account of the number of instruments required and the numerous readings, while the measurement with the wattmeter is extremely simple. Furthermore, the indications of the instruments must be very precise and

the readings very exact in the three voltmeter method; he finds that errors of 0.5 per cent. in the single readings can cause an error of 10 per cent. in the final result. In the three voltmeter method, the self-induction and capacity of the volt and amperemeters and the power consumed by the instrument should be considered very carefully. He describes a graphical method showing how to make the necessary corrections.—*Elek. Zeit.*, Oct. 5.

Calculation of Rheostats.—GIRAULT.—A short article developing analytically an apparently paradoxical result. The calculation of rheostats is based in general upon the hypothesis that the rise of the temperature of the resistance wire, over that of the surrounding air is proportional to the number of watts dissipated per square centimeter of surface, which method yields a quick and practically sufficient means of calculating commercial rheostats and of making comparisons. If two metals differ from each other only in their specific resistances, all other physical constants being equal, such as the specific heat and the condition of the cooling surface, and if two rheostats are constructed of them, having the same resistance and the same rise of temperature for equal currents, the analytical calculation shows that the rheostat made of the metal with the smaller specific resistance has the smaller volume. If all other things are equal, the rheostat is therefore smaller, the smaller the specific resistance of the metal, which seems to be a somewhat paradoxical result, when only the resistance and not the cooling effect of the surface is considered. It is certain that soft steel wires and bands have advantages over the alloys usually used.—*L'Ind. Elec.*, Sept. 25.

Inductance Factor Meter.—BABCOCK.—An illustrated communication describing a simple means of measuring the inductance factor, which he discovered accidentally in the Stockton station during tests of Thomson recording wattmeters. One meter refused to move although the lamps were up to their usual brightness, and all circuits were closed. It was found that the lamps were on one of the two-phase circuits, while the potential coil was across the other phase. As only lamps were in circuit, the current was in phase with its own pressure, but lagged 90 degrees behind the pressure of the other phase, to which the potential coil of the instrument was connected, so that apparently the reading must be zero. He points out that if the current of the phase in which the fields of the meter were connected had been either leading or lagging, the wattmeter would have indicated the wattless component instead of the active; this affords a simple means of measuring the wattless component.—*Jour. of El'ty*, Sept.

Clark Cells.—COHEN.—He arrives at the same conclusions as others, namely, that the fortuitous variations of the Clark cell are due to the presence of crystals in the solution.—*Zeit. Phys. Chem.*, 38, p. 723; noticed briefly in *Science Abstracts*, Oct.

REFERENCES.

Damping of Galvanometers.—LEMKE.—An analytical theory of the damping of the magnet in a galvanometer.—*Wied. Ann.*, April; abstracted in *L'Eclairage Elec.*, July 29.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telegraphy.—An illustrated account of the English patents of Marconi. The fundamental patent of 1896 describing the apparatus in his original experiments is briefly noticed. The substance of his next three patents is given at some length. In his patent of Sept. 12, 1898, he describes how he encloses the receiver, containing the sensitive tube, in a box of thick metal with a small opening, and specifies the use of the same vertical wire and earth plate both for the transmitting and receiving apparatus, with a switch for connecting these to either instrument. Two small apertures in the box are necessary for making contact to the terminals of the sensitive tube. A method is described of connecting the switch lever to two shutters by means of a cord passing over pulleys, so that the apertures are closed as the lever is turned over to the transmitting position. The patent of June 1, 1898, relates also to the enclosing of the receiving apparatus in its iron box. Another patent of the same date refers to the receiving apparatus of his 1896 patent, "in which the ends of an imperfect conductor in a local circuit were connected, one to earth and the other to an insulated conductor," and states that, according to the present invention, the conductor is connected to earth or to a suitable capacity through the primary of an induction coil or transformer, while the ends of the "imperfect contact" are connected to the ends of the secondary, one of the connections passing through a condenser. This arrangement is described in detail with diagrams and a table giving particulars of coils which have been used successfully. Four other patents are still in their provisional stage.—Lond. *Elec.*, Oct. 6.

Wireless Telegraphy.—TURPAIN.—A communication criticizing the exaggerated hopes of the public for the possibility of wireless telegraphy to any distance. The two main difficulties are that a bundle of waves, if emitted in a certain direction in cylindrical form, will continually become conical; and secondly, that the power of the transmitter must increase as the square of the distance. The practical use of wireless telegraphy should be confined to messages between lightships and the coast, between ships, between trains, etc.—*L'Eclairage Elec.*, Sept. 2.

Wireless Telegraphy in the French Navy.—TISSOT.—He uses platinum electrodes in his coherers; the filings are of silver coated with a sulphide; the current density is kept high and the tubes are semi-capillary; the receiving wires are not connected to any body having capacity, and it is not necessary that they be vertical but merely that they should be at right angles to the direction of propagation.—*Soc. Franc. Phys. Bul.*, 130, p. 2; noticed briefly in *Science Abstracts*, Oct.

Public Telegraphy in Germany.—The first part of a very long abstract of an official report on the development of public telegraphy in Germany since 1849, in which year the government telegraph was opened to the public; it is also discussed editorially. Per 100 inhabitants there were 64 telegrams in 1897 in Germany, 195.7 in England, 102.8 in France, 87.6 in Switzerland, 68.5 in the Netherlands, and 68.4 in Norway, which shows that the telegraphic traffic is relatively small in Germany. The number of telegraph stations is, however, relatively great. In 1897 there was one station for every 24.4 square kilometers and 2362 inhabitants in Germany, for 18.4 square kilometers and 1534 inhabitants in Luxemburg, for 20.7 square kilometers and 1461 inhabitants in Switzerland, for 31.1 square kilometers and 3884 inhabitants in England, for 45.1 square kilometers and 3237 inhabitants in France, and for 36.8 square kilometers and 5573 inhabitants in the Netherlands. In Germany the telegraph is controlled by the government in combination with the mail department, and for transmitting telegrams to small stations the telephone is used. The telegraph department was formerly combined with the war department, and for this reason the simplest forms of apparatus are in use; these stations are, therefore, not equipped as well as in other countries. The organization of the service, however, is claimed to be excellent.—*Elek. Zeit.*, Oct. 5.

Canadian Telegraph System.—A note stating that the Dominion Government is about to make two important extensions, one from Lake Bennett to Dawson City, for which 330,000 pounds of iron wire will be required. The second is the extension of the Gulf of St. Lawrence telegraph system from Big Roumaine, Quebec, to Chateau Bay, Labrador, a distance of 350 miles. In connection with the latter extension probably wireless telegraphy will be used to communicate between the Labrador coast and Belle Isle.—*Can. Elec. News*, Oct.

Induction in Telephone Circuits.—COLARD.—A mathematical study of the distribution of current and potential in two parallel single wire telephone circuits taking into account all the various factors. He shows that it is not correct in practice nor in theory to simply superpose the effect of electrostatic induction calculated by itself on to electromagnetic induction in order to obtain the total; the simultaneous existence of both must be allowed for. For lines of moderate length with moderate frequencies he finds that an exceptionally low insulation between the wires does not increase the induction, and that the resulting leakages have only a very secondary effect on the induced currents.—*Bul. Ass'n Int. el Lege*, 10, p. 95; abstracted with some of the equations in *Science Abstracts*, Oct.

REFERENCES.

Wireless Telegraphy.—An extract with the diagram of the Dolbear patent of 1886, which the inventor claims is an anticipation of the system used by Marconi. The fundamental idea seems to be the creation of impulses or waves in the earth, which are then received by a distant telephone receiver.—*Elec. Rev.*, Oct. 11.

Wireless Telegraphy at the Yacht Race.—An illustrated article of a popular nature on the installation in use during the recent yacht races under the direction of Marconi. A short article on the Marconi system by his assistant, Bradfield, is also reprinted from the New York *Herald*.—*West. Elec.*, Oct. 14.

Wireless Telegraphy.—A short note on a successful installation of wireless telegraphy on one of the most dangerous parts of the French coast between two lighthouses some 35 miles apart. Other lighthouses on the French side of the Channel are to be connected in the same way.—Lond. *Elec.*, Oct. 6.

Interurban Telephony in Italy.—A brief note giving the tariff and a map.—*L'Eclairage Elec.*, Sept. 30.

MISCELLANEOUS.

Smelting Iron Electrically.—A positive denial of the statement that the Prague Iron Company has begun experimenting with a new method of smelting iron ore electrically (Digest, Sept. 30).—*Elek. Neuig. Anz.*, Oct. 1.

Stassano Process for Electrically Producing Iron and Steel.—VOGEL.—Some remarks on the Stassano process, which was referred to in the Digest, Sept. 30. It is stated that experiments in Rome have been so successful that a company has been formed to use this process commercially in an electric plant in the valley of Camonica in Italy. Three electric furnaces, each of 500-hp, will be constructed, and the output expected is 4000 tons per year. The process is described and the costs are given, the data being the same as that referred to in the Digest, Sept. 30. A special advantage of the process is said to be the possibility of using the carbonous oxide formed in the electric furnace, for the further treatment of the metal, as for heating the welding furnaces, etc. It is also claimed to be easy to produce alloys of iron with manganese nickel, chromium or tungsten, or hard or soft steel, etc. Special data are given for the treatment of red iron ore and magnetic iron ore. One pound of iron can be produced from 1.429 pound of red iron ore, or of 1.380 pound of magnetic iron ore; the consumptions are 0.94 and 0.93-hp hours respectively. The recent experiments in Rome are described.—*Zeit. f. Elektrochemie*, Oct. 5.

Sterilization of Water by Ozone.—BLONDIN.—An account of the experiments made by Marmier and Abraham in Lille in France to use ozone for the sterilization of water. The effect of the ozone was found to diminish the amount of organic matter in the water and not to increase the contents of nitrates; also to destroy the microorganisms completely. The cost of the sterilization is given as 0.4 cents per cubic meter.—*L'Eclairage Elec.*, July 29.

ANDREOLI.—A long communication stating that he has been investigating this question systematically for a long time. His former apparatus was not an imitation of the ozonizer of Tisley, as claimed by Abraham; he criticises the report of the Lille commission mentioned in the foregoing abstract.—*L'Eclairage Elec.*, Sept. 2.

Electricity for Agricultural Purposes.—A note stating that near Buetthard, in Germany, there is an electric plant now in course of erection, intended chiefly for agricultural purposes. Three-phase current at 5000 volts, generated by a turbine and a steam engine, will be conducted to six villages in the neighborhood, where electric motors will drive threshing machines, etc. The villages will be lighted electrically.—*Elek. Zeit.*, Oct. 5.

Electrical Changes Accompanying the Discharge of the Respiratory Centre.—The report of a special committee of the British Association, giving the results of an investigation concerning the nature of the part played by alterations of blood pressure in causing the electrical phenomena observed in the phrenic centre. The final conclusion is that the phenomena in phrenic nerves are in no way due to local changes of blood pressure or of circulation.—Lond. *Elec. Rev.*, Oct. 6.

New Books.

THE FUNDAMENTAL LAWS OF ELECTROLYTIC CONDUCTION. Memoirs of Faraday, Hittorf and F. Kohlrausch. Translated and edited by H. M. Goodwin, PhD. New York: Harper & Brothers, 96 pages. Price, 75 cents.

A complete theory of electrochemical action in harmony with the facts is yet to be constructed. Faraday's law of electrochemical change is a necessary deduction from the chemical laws of definite and multiple proportion. It must be the basis of any rational theory of electrochemical action, and is undoubtedly the fundamental law of electrolytic conduction. Hittorf's generalization of transport numbers is not necessarily a law of electrochemical action or conduction. His results may be due entirely to diffusion subsequent to and caused by change of density of the electrolyte. Any other cause besides electrolysis, producing local change of density in one constituent of a mixture, might and probably would produce Hittorf's migrations. If this should prove true, the generalization of Kohlrausch would signify merely that the conductivity of an electrolyte is proportional to the quantity of conductor available at the surface of the electrode, or that the conductivity is proportional to the sectional area of the conductor.

Without denying that these researches of Hittorf and Kohlrausch are entitled to a place by the side of Faraday's, and without denying the undoubted merit of their hypotheses, we would venture to suggest that the assumption implied in the title of this book is hardly justified by its contents. Nevertheless, it is well worthy of a place in the series of "memoirs," to which it belongs.

BOOKS RECEIVED.

PROJECT FUR DAS ELEKTRICITATS-WERK DER STADT WARSCHAU. Von W. H. Lindley. Folio, with plans, maps and diagrams.

KEY TO ENGINES AND ENGINE-RUNNING. By Joshua Rose, M.E. New York: D. Van Nostrand Company. New Edition. 410 pages, 165 illustrations. Price, $2.50.

THE CENTENARY OF THE ELECTRIC CURRENT. 1799-1899. By Dr. J. A. Fleming, M.A., F.R.S. London: The Electrician Printing and Publishing Company. 62 pages, 25 illustrations. Price, 50 cents.

TABLES OF SQUARES. Containing the True Square of Every Foot and Fraction Thereof from 0 to 100 Feet, Advancing by One-Sixteenth of an Inch. By John L. Hall. New York: Engineering News Publishing Company. 100 pages. Price, $2.00.

ELECTRIC MOTIVE POWER. The Transmission and Distribution of Electric Power by Continuous and Alternate Currents. By Albion T. Snell. Second edition. New York: The D. Van Nostrand Company. 410 pages, 224 diagrams and illustrations. Price, $5.00.

The Monarc Arc Lamp.

The Monarc arc lamp which was placed on the market some time ago by the Albert & J. M. Anderson Manufacturing Company, of Boston, has some features of construction interesting to arc lamp users. The accompanying cuts will serve to illustrate this. The first glance gives an impression of simplicity and rugged construction. The lamp is of the simple series type; that is to say, the controlling magnet is in series with the arc. This simple arrangement was only reached after considerable experiment with compound magnets and similar devices. Many lamps with simple series mechanisms are first attempts, but in this respect the Monarc arc lamp is an exception.

The lamp is built upon an iron frame as a nucleus, in the central part of which is mounted a tube thoroughly insulated by heavy mica washers. In this tube the positive carbon slides, the inner end of the carbon fitting into a clutch or cap. A projecting lug from this cap passes through a slot in the side of the tube, and is connected to the magnet terminal by a flexible wire. There are no sliding contacts whatever in the lamp circuit. The negative carbon is clamped in the lower end of the arm in a brass sleeve, also thoroughly insulated by mica washers. The inner globe has a special feature. It carries no ferrule and is not rigidly confined in any way. It simply rests with its lower end on the carbon holder and its upper end secured by a somewhat heavy cover, which rests upon it and is prevented from being displaced by two notched projections engaging with the side arms of the lamp. This arrangement while leaving the inner globe perfectly free is still sufficiently tight to give 150 hours burning on a single trim. Only one side arm is extended to the negative carbon holder thereby causing but little shadow.

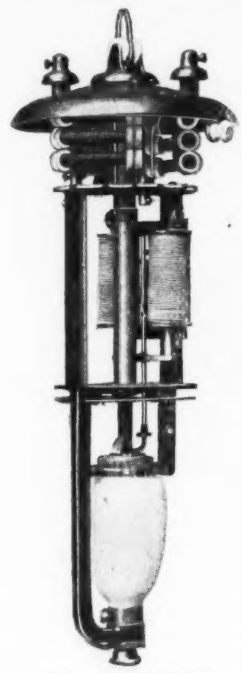


FIG. I.—MONARC LAMP.

The cover of the inner globe carries a heavy soapstone disc, on which is mounted a washer clutch acting on the positive carbon. This clutch is connected with the magnet mechanism through an insulating joint which may be seen in the figure, and a stiff rod passes directly up to the magnet armature. There is thus only one loose joint in the moving parts, namely, the joint between the washer clutch and the rod which actuates it. An air dash is provided which acts only on the up stroke, thereby preventing the lamp from chattering or jerking, but in no way affecting the feeding. The magnet is a double solenoid and with its dash pot is mounted on a separate frame, so that the entire magnetic mechanism can be at once removed and renewed. A fuse is provided in the upper part of the lamp casing, a recent underwriter's requirement.

Above the mechanism case is mounted the regulating resistance, which consists of a system of spirals of Krupp wire passing through bushings. A movable clamp is provided to adjust the amount of this resistance. This resistance is fastened on the upper hood and comes away with the latter as shown in one of the accompanying cuts. In the top part of the hood is also installed a switch, the porcelain knob of which protrudes on the outer side of the case. The binding posts of the lamp are fastened in the upper hood, and have petticoats to shed water from the holes through which the conductors enter. A particular feature of value of this lamp is the quick trim. A man steps to the lamp with the positive carbon in his hand. With the free hand he unscrews a little base cap and loosens a thumb nut. The negative stump at once drops out on the ground and the positive stump falls forward sufficiently far so that it can be withdrawn. A quarter turn locks the carrying cap of the positive carbon so that the new carbon can be thrust in place. A second turn releases the carrying cap, and the new carbon is thrust up into the lamp, followed by a sufficient length of the old carbon to make a new negative stump. A suitable amount is cut

FIGS. 2, 3 AND 4.—MONARC LAMP AND PARTS.

off, the base screw is put on and the work is done without removing the inner globe.

The general appearance of the Monarc arc lamp is so familiar that it is merely necessary to say that it is made in several styles, two of which are illustrated here. It is, of course, supplied with clear or opalescent globes and with outer globes or shades as may be desired.

New G. I. Push-Button Switch.

The new type of push-button switch, illustrated herewith, is designed to go into any standard switch outlet box that will accommodate any of the usual types of push-button switches. It is also designed to obviate many of the difficulties ordinarily encountered with such switches, of which several are enumerated below.

In making porcelain parts for switches where a box-shaped base of porcelain is necessary, it is well known to be practically impossible to have the shape after baking come out absolutely true, when the parts are thin, as in the case of a box for an electric switch. This defect also makes the porcelain base fragile and if the porcelain box is broken or cracked the work of the switch is impaired. In the new switch the contacts are mounted on separate blocks of porcelain, which are substantial through being straight, and made in a mould that will insure absolute uniformity in baking. Should the porcelain parts become broken, it is very easy to replace them without necessarily disturbing any of the other parts of the switch.

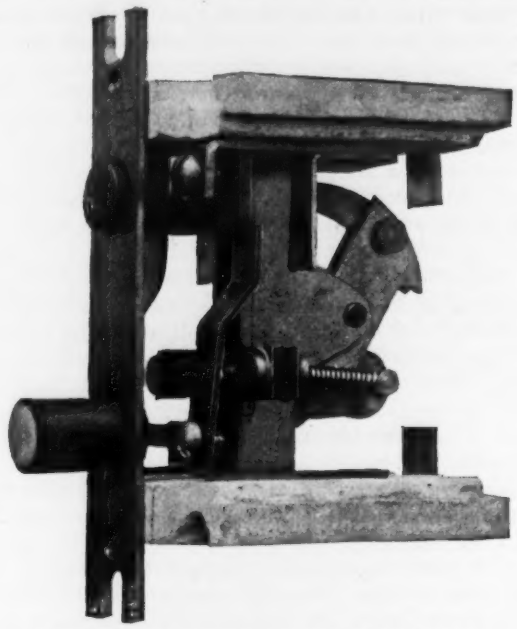


FIG. 1.—PUSH-BUTTON SWITCH MECHANISM.

The contacts have a capacity of more than twice the rated capacity of the switch, and the contact parts in the moving part being in themselves movable, adjust themselves to insure a safe carrying capacity. They also clean themselves in the action of the switch.

The mechanism itself is the simplest possible, and insures absolute certainty of a quick make-and-break of the contact parts. After the buttons have been pushed a certain distance, the making

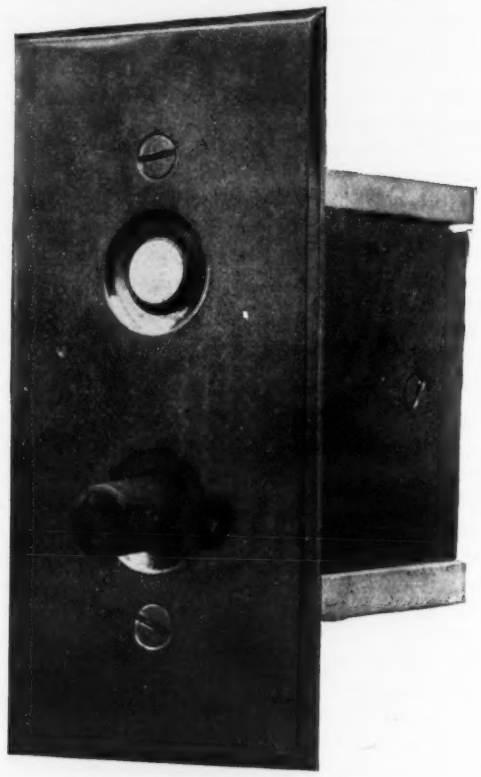


FIG. 2.—PUSH-BUTTON SWITCH.

and breaking of the contact is absolutely under the control of the hand. The special construction of the moving parts also insures certainty with regard to the switch being left on any dead centre.

The parts of the switch are all made by tools, no casting whatever being used, thus insuring the desirable feature of having the parts interchangeable so that repairs may readily be made by inexperienced people, which many times means the saving of expense

for a new switch. The switch is also designed to have an unusually large distance break and can readily be used on a 230-volt circuit. The switch has a removable cover, which gives access to the working parts in case the switch becomes out of adjustment, when it can very readily be adjusted. The connection of wires is very readily made in this switch, the contact screws being readily accessible and ample space allowed for the leading-in wires. The manufacturers are the General Incandescent Arc Lamp Company, New York.

Large Circuit Breakers.

Our attention has been called to a statement in last week's issue to the effect that a circuit breaker exhibited at the International Export Exposition at Philadelphia, and having a capacity of 4000 amperes, is the largest yet made. On page 75 of our issue of Jan. 21, 1899, is mentioned a circuit breaker made by the General Electric Company of 8000 amperes capacity, and the same company has more recently made one for the Boston Elevated Railway of 10,000 amperes capacity.

Water Gas in Boston.

The manufacture of water gas is to be discontinued in Boston within a few months. There has been a steady increase in the city during the last six years in the number of deaths, accidental and suicidal, from the water gas, and it is believed by the health authorities that for each death caused by this means there are one hundred persons suffering more or less from the escape of the same gas.

Exhibits at the Street Railway Convention, Chicago.

PECKHAM TRUCK COMPANY was represented by Messrs. Hanna & Gray, who had on view two single Peckham trucks equipped with motors, one of which was in operation and which showed the paces of the McGann air-brake.

PASS & SEYMOUR, of Syracuse, and the Crouse-Hinds Electric Company, were represented by Mr. John W. Brooks, western agent, who pushed the interests of their respective porcelain, drop sockets, switches, switchboards, etc. He issued circulars on the subjects named.

THE TECHNICAL CLUB, of Chicago, through Messrs. F. E. Donohoe, R. H. Pierce and others, issued cards to engineering members of the convention who were much in evidence there during the week. In fact, all the Chicago clubs had a distinct street railway atmosphere while the convention lasted.

STANDARD PAINT COMPANY, of New York, were represented by Messrs. F. S. De Ronde, general manager; J. C. Shainwald, Chicago manager; F. S. Howard and O. A. Heppes. There was a very neat and attractive exhibit with a warm welcome for all friends and admirers of the famous P. & B. specialties in insulation. Everybody seemed to be in there at one time or another. As a souvenir, the company distributed a really valuable card case in black leather and one in dainty white for the ladies. They were in eager demand, and deservedly so.

SPEER CARBON COMPANY, of St. Mary's, Pa., were a newcomer on the street railway stage, but as represented by Messrs. John S. Speer and Andrew Caul, Jr., were neither backward nor retiring. In fact they were the centre of a football rush, owing to the anxiety to secure their souvenir purses and cigar cases. Not less in demand, however, was their remarkably comprehensive catalogue for a bewildering variety of generators and motors, giving the style and dimensions of their Speer carbon brushes for each kind. Samples of their railway brushes and other carbon products were shown in the exhibit of Elmer P. Morris.

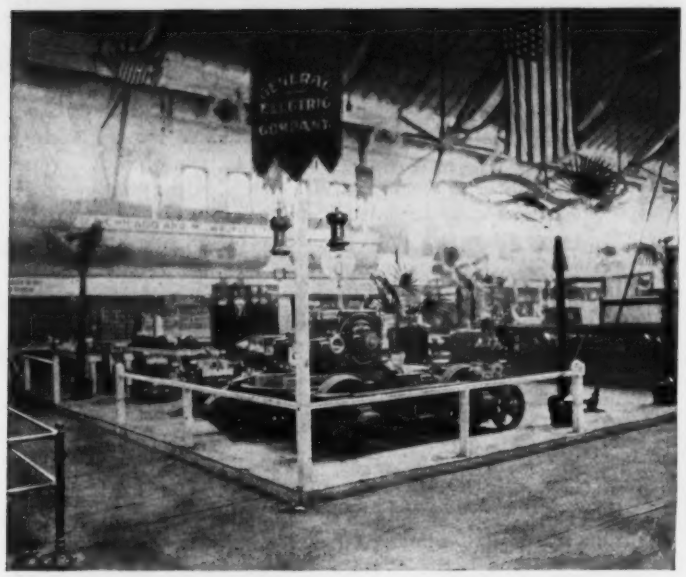
THE BROWN SOLID COPPER BOND was one of the novel features of the convention. Mr. Harold P. Brown had a multum-in-parvo exhibit illustrative of the merits of his new and valuable solid copper bond, which is covered with the Edison-Brown plastic alloy, and commends itself in many ways as a cure for the evils of track resistance. To show how the bond reduces the resistance of the return, Mr. Brown had a working outfit of an Edison motor running a Zucker-Levett low-volt double armature generator with Ward Leonard rheostat and fine Weston milli-volt and ampere indicators, so that tests could be actually made on rail sections with the Brown bond or any other kind. Mr. Brown made constant demonstrations in this way, and the intense interest taken in them was proved by the crowd in and around his exhibit all the time. A handsome descriptive pamphlet was given away to all inquirers.

ELMER P. MORRIS won the title of the Pooh Bah of the electric railway industry, for his exhibit exemplified the whole range of the industry. If you wanted to see anything, you did not have to ask for it. The space of the Morris Electric Company was one of the largest in the show, but even thus could hardly escape crowding owing to the pressure of those desirous of visiting the High Ball Grounds, to which the way was lighted by the Hunter illuminated sign. Among the endless exhibits were the Speer carbons, the Anderson line material, the Morris rail bonds, the Garton lightning arresters, the line material of the Electric Railway Equipment Company, the circuit breakers of the General Equipment Company, the Munder incandescent lamps, the Thomas-Bock high-voltage insulators, the Dale shades and clusters, the Cameron assembled commutators, the Potomac Terra Cotta Company's conduits, etc.

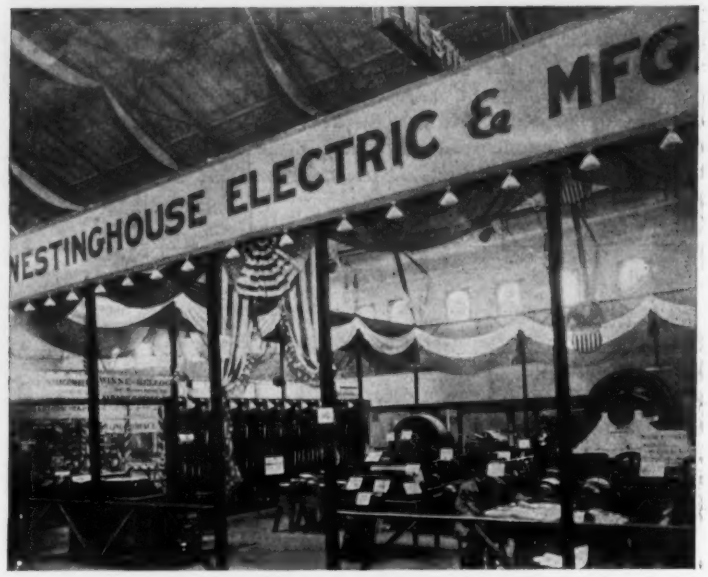
THE CONTINUOUS RAIL JOINT COMPANY had an interesting exhibit of their joints, which are now in use on some eighty roads in the United States. In street railway work, the bad joint which was the salvation of the telephone transmitter is the damnation of the whole means of communication, for track, cars, current, power house, motormen and passengers all suffer from it. The continuous rail joint is fitted most successfully to girder rails, T-rails and other intermediate types, insuring perfect alignment and smooth running. It holds up the rail head just as Aaron sustained the hands of Moses—giving great vertical strength with increased bearing surface, so that motion, play and wear are minimized. It is obvious also that with fewer bad joints, there is less necessity to tear up the street. The company had a good exhibit in space 44—that was its joint. It was represented by Messrs. J. F. Braine, W. F. Ellis, F. C. Schmitz and H. M. Montgomery.

A TRIP TO THE SOUTH SIDE ELEVATED.—At the invitation of the Westinghouse Electric & Manufacturing Company, about 100 attendants at the convention left the Congress Street station of the South Side Elevated Friday afternoon and were taken by special train to the Fortieth Street power station of the South Side Elevated Railroad, where they made a thorough inspection of this well-equipped plant. Three out of the four 800-kw Westinghouse generators connected to Allis engines were in operation. The new Westinghouse high-pressure circuit breakers were shown in detail to the visitors. The massive foundations being built for the two new 1500 Westinghouse generators in process of erection at the south end of the station were also examined. Before leaving the party was grouped around one of the large units and photographed. The Westinghouse Company distributed some excellent literature on the subject, with good cigars for consumption during its perusal.

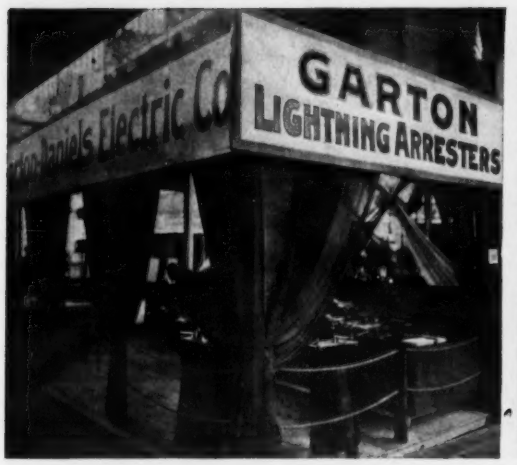
HIPWOOD-BARRETT CAR & VEHICLE FENDER COMPANY, of New York City, had a most interesting and attractive exhibit in charge of President Dalby, Mr. Hipwood and others of their ingenious fender. The exhibit consisted of three main parts. One was a complete model car equipped with the fender and running over a roadbed made frightfully rough and uneven. Another was the full size front of a car equipped with the regular Hipwood-Barrett fender in operation. The third and perhaps most striking of all was a mutoscope exhibition of an actual test with the fender at Newtonville, Mass., where it picked up and nursed gently various dummies, while the car was running at fifteen miles an hour, restoring them to the bosom of their families. The fender is one of the most effective pieces of scientific mechanism for life-saving on the streets so far brought to notice. It can be run under the car when not in use, and when run out forward, the light pressure of the motorman's knee on a pad releases it for action. In front of the dashboard is the strip steel tray, and forerunning it is a series of sectional lids or flaps each adjusting itself to the upward pressure of any inequality in the track just as the ivories of a piano keyboard yield to the downward pressure of the player's hand. The moment any object is caught it is held and cradled until the car stops, when it is released uninjured, except perchance with a bruise or two at the most. The car may oscillate as it will, and the track may be as uneven as the skyline of New York, but the fender adapts itself to everything and does its work. A point not beneath mention is that the fender can be painted to match the car to which it is attached. A large number of orders celebrated the convention week.



THE GENERAL ELECTRIC COMPANY.



THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.



GARTON LIGHTNING ARRESTERS.

THE STANDARD PAINT COMPANY.

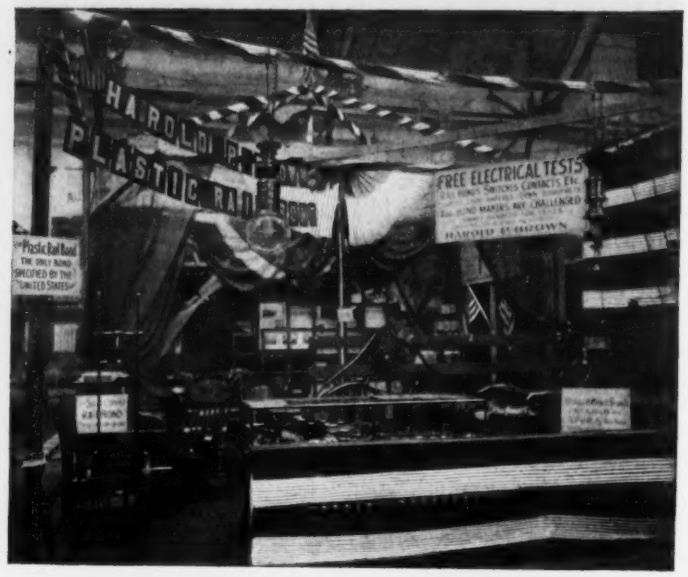
THE CENTRAL ELECTRIC COMPANY.

EUGENE MUNSELL & CO. AND MICA INSULATOR COMPANY.

AMERICAN STEEL & WIRE COMPANY.

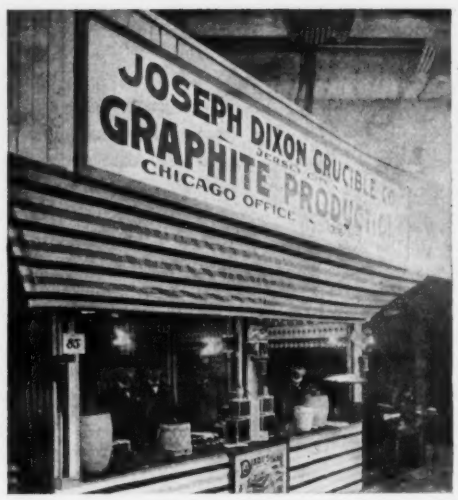
SOME OF THE EXHIBITS AT THE STREET RAILWAY CONVENTION, CHICAGO.

THE FALK COMPANY.

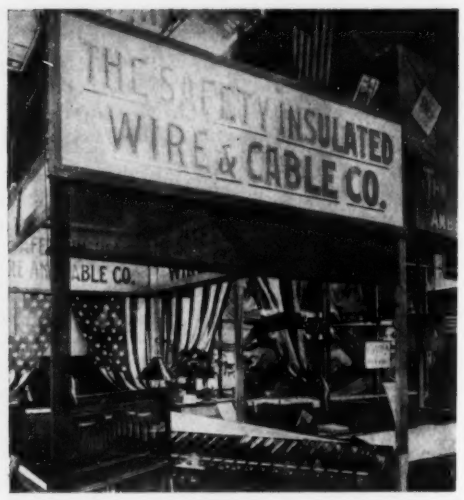


HAROLD P. BROWN'S EXHIBIT.

GOLD'S ELECTRIC HEATERS.

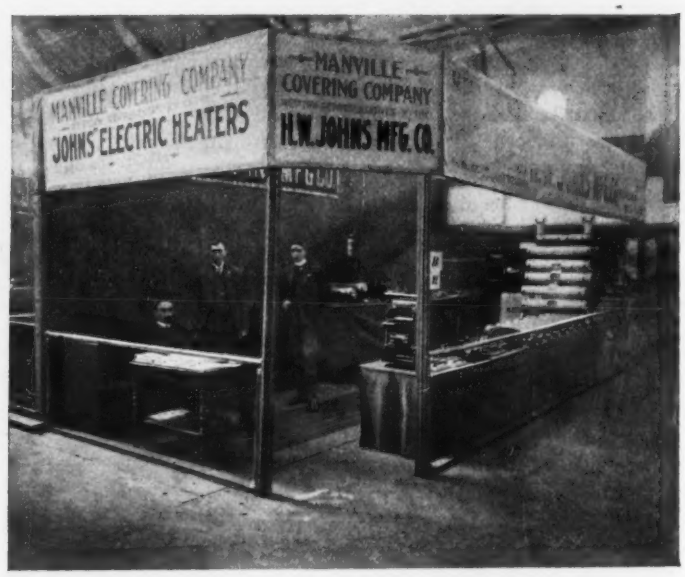


JOSEPH DIXON CRUCIBLE COMPANY.



THE SAFETY INSULATED WIRE & CABLE COMPANY.

K. M'LENNAN & CO.



H. W. JOHNS MANUFACTURING COMPANY.

SOME OF THE EXHIBITS AT THE STREET RAILWAY CONVENTION, CHICAGO.

PARTRIDGE CARBON WORKS, of Sandusky, were represented by Mr. James Partridge, their well-known and active manager.

MR. J. T. McROY was present in the interests of his conduit, for which street railways have provided him with a big market the last two years.

MR. J. P. McQUAIDE looked after the interests of the National Conduit & Cable Company, and reported business as astoundingly brisk in all their lines.

NATIONAL CARBON COMPANY, of Cleveland, had as reminders some remarkably well executed medals in engraved carbon, which were much sought after by those familiar with the excellence of their product.

SIEMENS & HALSKE ELECTRIC COMPANY were represented by W. G. de Celle, W. H. Abbott, W. R. Mason, C. E. Wilson and Alex. Churchward, of their engineering staff. No exhibit was made, but the factory was open to all comers.

CONSOLIDATED CAR HEATING COMPANY, of Albany, made a pretty display of their electric heaters and new visual three-point switch, in the hands of Mr. R. S. Scales, western agent; W. P. Cosper, St. Louis, and J. H. Dubarry, New York.

STANDARD AIR-BRAKE COMPANY, represented by Messrs. J. R. Ellicott, E. H. Beacham and G. E. Baker, showed their whole system, including the independent motor-driven compressor operated by Storey motor. A neat catalogue was distributed.

JOHN A. ROEBLING'S SONS COMPANY were represented by a most active corps of experienced men. It comprised Messrs. M. R. Cockey, G. W. Swan, H. Jenkins, A. B. Conover, W. P. Bowman, H. E. Fisher and A. M. Whaley, representing east and west, and all keenly bent on doing business.

ALUMINUM WIRES AND CABLES occupy the thoughts of a good many electrical engineers to-day, so that while the display of the Pittsburg Reduction Company was neither large nor conspicuous, it caught the attention of all the delegates. It included a selection of wires and cables running through a remarkable variety of sizes.

R. D. NUTTALL & COMPANY, of Pittsburg, had a neat exhibit of trolley poles, springs, gears, pinions, etc., in care of Mr. F. A. Estep, president. A combination exhibit was made by Mr. G. Myers, as president of the Standard Railway Supply Company, and C. N. Wood, of Boston, the latter showing the Wilson trolley pole catcher, a simple device for keeping the contact wheel in place.

MR. G. F. PORTER was present in the interests of W. R. Brixey's Kerite wires and cables, and was credited with having captured one of the biggest foreign electric railway orders recently given out. He had a few samples with him of their productions. As secretary of the National Electric Light Association, Mr. Porter has a deep personal interest in the doings of the sister body, and never misses a convention.

BADT-GOLTZ ENGINEERING COMPANY, of Chicago, were represented by Mr. F. B. Badt, whose literature for the occasion was a pocket calendar of 1899-1900. In the exhibit of Mr. Harold P. Brown, whom he assisted, Mr. Badt showed a Ward Leonard rheostat and two remarkably fine special Weston instruments. These he represents out west, as well as the Edison-Brown plastic bonds, Helios arc lamps, etc.

MR. GUIDO SEMENZA, the chief engineer of the Milan, Italy, electric lighting system, was a most assiduous attendant at the meetings of the convention. The city has a population of 500,000 people and has had an Edison plant since 1883. The latest work is based on the Paderno 21-mile transmission at 13,000 to 15,000 volts, as described already in these pages. Of this current there is 13,000-hp added to the 5000-hp in the old steam station. Mr. Semenza has been actively engaged in street railway work and takes great interest in its development. He states that in Italy tests are to be made of three-phase work with 3000 volts on the car motors, two wires being overhead and the track being the third.

LORAIN STEEL COMPANY were represented by Messrs. P. M. Boyd, S. P. S. Ellis, F. A. Merrick, W. W. Kingston, R. T. Lane, H. C. Evans, O. C. Evans and A. S. Littlefield. In addition to their exhibit of trucks, rails, special switches and crossings, they showed some interesting electric welds from track laid in Buffalo. The display included also some of the well-known "Steel" motors and two of their new type of car controllers. One of these was a single controller in actual operation, the other was what may be considered as a double controller, as it will govern the relations of four motors under a car up to say, 150-hp. A feature of these controllers is the lessening of the work and responsibility on the motorman, as well as the advanced simplicity of the internal mechanism.

THE WESTERN ELECTRIC COMPANY were represented at the convention by Messrs. J. C. Cannon, Philip Rust, F. L. Swan and T. G. Grier. They had headquarters at Booth 30, where they entertained friends of the company and distributed printed matter and souvenirs to the visitors. Mr. A. L. Tucker, of the company, was one of the committee on publicity for the Street Railway Convention, and also participated in the exercises part of the time. The souvenir distributed by the company was a match box having on one side an illustration of a Petite arc lamp, on the other an illustration of a 16-inch fan motor, and on both edges of the box, "Western Electric Company, Chicago-New York." The box is finished in silver and white celluloid.

ROSSITER, MACGOVERN & COMPANY, of New York, had parlors at the Auditorium, where Messrs. Frank MacGovern and J. A. Steuart were in unremitting attendance. The company is in such close relation with the street railway art and its leaders in the industry that the principal of the concern found his energies absorbed all the time, except when making new acquaintances, who were delighted to discover his varied ability. The acquisition of the Excelsior Electric Company's plant, in Brooklyn, led to many inquiries as to just how far Mr. MacGovern intended to push things. His irresistible approach will certainly carry him far. During the convention he and President Rogers, of the New York State Association, took in together most of the sights that they considered really worth seeing in the western centre of street railway enterprise.

EUREKA ELECTRIC COMPANY, 157-159 South Canal Street, Chicago, were represented by Messrs. I. J. Kusel, president; H. J. Kusel, vice-president, and Arthur Stein, secretary and treasurer. They had the distinctly telephonic exhibit of the convention, and secured no small amount of attention. The uses of telephony in street railway work are obvious and numerous, and the company was able to show that it had bestowed thought upon them all. Special attention was called by the exhibitors to their telephone equipments for street car lines for emergency work, and a great variety of well-built moderate-priced apparatus was displayed on the walls, its merits being opened to the closest scrutiny. The company are making express boards, cross-connecting and distributing boards, transmitters, receivers, magnetos, extension bells, desk sets, arresters, cutouts, generators, testing sets, bridging telephones, etc., and have brought to bear on all of it great care and ingenuity.

GOLD CAR HEATING COMPANY, of New York City, had one of the most effective exhibits in the building, and was most admirably represented by Mr. E. E. Gold, president; Mr. John E. Ward, general manager; E. H. Gold, western representative; F. Weston, New York, and J. Watson and T. Downing, western salesmen. The exhibit was a very complete illustration not only of their lines of electric car heaters of the spiral coil type but of heaters for warming public and private buildings. The high efficiency and economy of this apparatus is familiar to all engaged in the electrical field. The company had a supply of literature on hand, as well as copies of a pithy circular as to the decision in their favor recently in the courts. Not content with all this, the Gold Company added to the impression it made by distributing with a free hand a very tasteful and pretty little leather card case and note book. When the show was over, a large number of orders for heaters had been filed.

SAFETY INSULATED WIRE & CABLE COMPANY, of New York, were represented by their western agents, Mr. E. J. Spencer, of St. Louis, and Messrs. Austin and Brown, of Chicago, who occupied a booth decorated with plants, etc. Lieut. Spencer showed two large sample boards neatly arranged and illustrative of some twenty or thirty of the Safety specialties. Among the exhibits were sections of the 6000-volt three-conductor cable for the Metropolitan Street Railway Company; the heavy equalizer cable used in Chicago power house work, and cables employed on the Chicago elevated roads. Another heavy type was the Niagara power cable. In addition to these, sections were shown of a ten-pair cable laid across the North River; the torpedo cable used in New York Harbor defence; cable used by Dewey at Manila; cable used by Col. Allen for splices to restore communication with Cuba and Puerto Rico; the Henry anti-induction cable, copper-sheathed for buoy lighting, as in Gedney's channel. All these and others attested the versatility and wide popularity of the concern.

STANDARD UNDERGROUND CABLE COMPANY made a neat display under the care of Mr. J. R. Wiley, their western representative, who had samples with him of many of their specialties used in electric railway work.

PIERCE & RICHARDSON, of Chicago, were represented by Messrs. R. H. Pierce, R. E. Richardson and S. G. Neiler. They have a large amount of street railway consulting work in Chicago, Salt Lake City and elsewhere.

MILLER-KNOBLOCK COMPANY, of South Bend, Ind., in the person of Mr. A. W. Morrell, manager, found an excellent representative, and gave in their admirable exhibit a good idea of their assembled commutators for street railway work.

SARGENT & LUNDY, consulting engineers, of Chicago, were represented by Messrs. F. Sargent and A. D. Lundy. They are not only interested in the electric elevated work going on in Chicago, but have in hand a lot of work for the big cross-country system of the Union Traction Company, of Anderson, Ind.

AMONG FOREIGN VISITORS at the convention were Mr. I. Loewe, president of the Union Electricitaats Gesellschaft, of Germany; Herr E. Arnhold, president of the Berlin Tramways, and Herr Hamspohn, director in the German, British and French Thomson-Houston Companies. These gentlemen have also been attending the Commercial Congress in Philadelphia.

WESTERN ELECTRICAL SUPPLY COMPANY, who have done so much of late in building up St. Louis as an electrical supply centre, were represented by Mr. Charles Scudder, Jr., manager of their street railway department, who is doing his best to fill up his territory with some of the most popular material in the market. As a railway centre, St. Louis has now few equals.

CENTRAL ELECTRIC COMPANY, of Chicago, were represented by Mr. M. M. Wood, who gave away a neat paper cutter. The booth was a handsome one, enclosed at the end by trolley poles. The main feature was a display board carrying handsome car fixtures, line material, etc., in the highest state of finish and polish. A number of pieces of special ornamental work attracted attention and were much admired.

CREAGHEAD ENGINEERING COMPANY, of Cincinnati, O., through Mr. G. R. Scrugham, superintendent, made a fine display of overhead line material, brackets, bonds, pole fittings, etc. Something worthy of special note was the extra heavy double bracket for centre pole construction as supplied to the New Orleans & Carrollton Railway. Supplementing the apparatus were a number of good photographs showing Creaghead material in use on roads all over the world.

K. McLENNAN & COMPANY, of Chicago, had a booth by the entrance in charge of Messrs. M. J. Isaacs, manager; J. Bert Castle and J. F. Wells. Their famous Gale commutator compound does not admit of much variety in display, but it gets there just the same, and samples were very much in request, as well as the little Mauser cartridge transformed into a concealed pocket knife. On the outside of the booth a number of testimonials were shown, including the original manuscript of some of them.

DIXON CRUCIBLE COMPANY had a booth near the entrance, and at all hours it was so full the representatives of the company could not collect fares. Graphite was very much to the front, as well as Dixon's graphited wood grease, one of the most mollifying influences extant for car gears. Messrs. S. Mayer, D. Johnson, A. L. Harris, E. A. St. John and W. Allen when not taking in orders, gave out Uncle Sam pencils, plumbago medals and a few other knicknacks likely to make a mark.

OHIO BRASS COMPANY, Mansfield, O., made an extremely handsome display of their beautiful products grouped on a large central table pyramidal fashion with a large blue banner over it carried on massive brass standards. The exhibit included a full line of their trolley wire devices, feeder wire appliances, track bonding materials and motor and car supplies. They distributed a handsome little souvenir hanger in brass and insulation which most delegates wore as a boutonniere. The company were represented by Messrs. C. K. King, A. L. Winkinson, G. A. Mead and R. A. Byrns.

GARL ELECTRIC COMPANY, of Akron, O., were represented by Mr. M. Garl, who showed their street railway telephone and other varieties. Their novelty is a portable pocket telephone for the motorman. The receiver and transmitter are virtually one instrument, the receiver forming a cap over the transmitter, the whole weighing about a pound. The set can be connected into the line at any station by simply removing the cap. Mr. Garl also showed a novel fire and burglar alarm which explodes a cartridge with the noise of a million ampere fuse. His illustrations of its use made everyone sit up if they happened to be standing within half a mile.

CUTTER ELECTRICAL & MFG. COMPANY, of Philadelphia, had an excellent exhibit in the hands of Mr. V. C. Gilpin, of New York, and Messrs. McGill, Pomeroy & Company, their western agents. Their latest type of circuit breaker was shown and its many valuable features were dwelt upon to a host of interested visitors. A "laminated wedge" is one of the points of the main switch contact, furnishing high carrying capacity with minimum size. During the opening of the main switch, a shunt switch affords ample protection, its circuit being of low resistance and non-inductive, so that arcing is nullified. The final break is made on carbon. The strength and beauty of the mechanism, not less than its perfect adjustment to its work, were the theme of much admiring comment.

J. G. WHITE & COMPANY, 29 Broadway, New York, distributed during the convention a timely little brochure entitled "The Growing Magnitude of Electrical Industries," in which data is summarized so that an accurate opinion can be formed as to the amount of capital represented to-day by electrical applications. The total upon the figures presented would appear easily to exceed $3,000,000,000 in this country. The street railway industry alone is set down at $1,500,000,000, and authentic data is given showing that it must actually be somewhere in the vicinity of $1,750,000,000. Central station lighting is good for $600,000,000 and isolated work comes out at about $400,000,000. Telegraphy and telephony are estimated at $250,000,000 each, although that is a low figure for telephony.

AMERICAN STEEL & WIRE COMPANY had not only a large and striking exhibit of their products, but set them forth with much cleverness and artistic ability. The ample space was filled with goods and decorated, while overhead stood up a colossal Figure 8 rail bond, copper color, on which at night the words "Crown Bonds" were picked out in a hundred or two of incandescent lamps. Bonds were, in fact, very much in evidence, but constituted only a portion of the overflowing exhibit, which embraced all kinds of trolley wire, all kinds of insulated wire, feeders, armored cables, wire rope, fencing, car truck springs, guy and span wire, steel grates, galvanized telegraph and telephone wire, and other incidentals innumerable of their electrical and street railway work. Messrs. E. J. Pietzcker and G. P. Rider were in charge of this superb exhibit so truly illustrative of the wire and cable industry, and gave out as souvenirs solid leather pocket books.

GARTON-DANIELS ELECTRIC COMPANY, of Keokuk, Ia., had a neat exhibit in charge of Mr. J. V. E. Titus, who showed a complete line of arresters for car, pole and station, as well as their 500 and 800 ampere kicking coils. The operation of the Garton arresters was practically demonstrated, so that any one could judge for himself the absolute instantaneity of their operation. One of the distinct novelties of the convention was to be found in this booth in the shape of the "automotoneer," invented by the electrical engineer of the Chicago City Railway Company, Mr. G. W. Knox. It is a device which goes inside the controller case, and is built of malleable iron and drop forged steel. Its function is to prevent the too rapid starting up of the car, so that there is less drain on the power house for current and a more humane treatment of the motors, insuring their longer life as well as their coolness in running.

SPRAGUE INTERESTS were represented by Mr. C. A. Benton and Mr. Frank Shepard. The former had with him a large and detailed blue print showing the ingenious method recently worked out of applying Sprague elevators to the storage of cars, thus enabling power plants or car barns to run up several stories and utilize the real estate they stand on to better advantage. The type worked out by Mr. Sprague employs one of the heavy work elevators of which 49 have been sent to London for the new electric underground road. The passenger capacity of each of the elevators is 200 people, and this power applied to car elevation on the Sprague plan does the work handsomely. Any spare car in the barn can be used as the counterbalance, minimizing the current necessary. The weight of car to be lifted, with load of passengers, is taken at 40,000 pounds, and the weight of lifting platform at 10,000 pounds. Mr. Frank Shepard was present at the convention in the interests of the Sprague multiple-unit system, and Mr. E. B. Kittle looked after dynamo and motor matters.

AMERICAN VITRIFIED CONDUIT COMPANY, of New York, represented by Mr. B. O. Barnard, showed samples of its self-centering single and multiple ducts in its standard types of conduit for lighting and street railway work, exemplified on a large scale at Providence, R. I.

MR. BION J. ARNOLD had running along the front of the gallery above the General Electric exhibit a huge painting which showed graphically and pictorially the proposed line from Chicago to Milwaukee, and gave in detail his system already opened up as far as Waukegan, the details of which were given in our issue of Oct. 14.

WATSON-STILLMAN COMPANY, of New York, made a neat practical exhibit which included a motor lift for pit work, with a capacity of 3000 pounds; hydraulic rail punches, suited for punching a hole one inch in diameter in one-inch iron; jacks of seven and ten tons capacity; a hydraulic T-rail bender, and a hydraulic girder-rail bender.

H. W. JOHNS MFG. COMPANY had a large exhibit fronting on the main aisle, which included a full line of their molded mica overhead insulation material, the Noark indicating fuses, and their car and other heaters, Mr. J. E. Meek being in charge. The exhibit as a whole was got together by the concern's western representatives, the Manville Covering Company, who included also the asbestos pipe and boiler covering and asbestos roofing. They were represented by Messrs. H. A. Reeves, T. F. Manville and T. G. Younglove.

SIEGRIST LUBRICATOR COMPANY, of St. Louis, represented by Mr. J. N. Edelin, general manager, had a very nice exhibit of one of their latest improved automatic oiling tables, as well as of their automatic oil cups and lubricators. This apparatus is already familiar to electric lighting as well as street railway people, but was examined with much interest by all present. The literature of the company cannot be too highly praised. The company are able to point to some of the finest plants in the country as users of their system, and have strong testimonials to show in every case.

FALK COMPANY, of Milwaukee, Wis., had a large space set in a very handsome lot of framed photographs, illustrative of the track, overhead construction and power house of the Oshkosh & Neenah road, owned by the Citizens' Traction Company, of Oshkosh, all the work having been done by the Falk Company under the direction of its chief engineer, Mr. W. F. Carr. Other photographs illustrated work done all over the country and as far away as Cairo, Egypt. Special attention was called not only to their famous cast-welding, but to their gears and pinions. The representatives on the ground were Messrs. Otto H. and Herman W. Falk, E. A. Wurster, C. C. Smith, C. L. Jones, J. Wendell, Jr., and R. L. McDuffie.

DEARBORN DRUG & CHEMICAL WORKS, of Chicago, had a really gorgeous booth, a symphony in red and green, offset by flags galore. They were represented by R. F. Carr, vice-president and general manager; C. M. Eddy, secretary and treasurer; W. B. McVicker, eastern manager; T. J. McMaster, G. W. Spear and A. Ruffner. The work of this concern in testing and purifying boiler water and in the introduction and selection of good lubricants is well known to our readers. They showed in their space not only the results of poor water and worse compounds on boilers, but pointed out the superiority of vegetable extracts for feed water treatment. They exhibited also a very complete line of oils and greases for power plant work. As souvenirs, they gave away valuable pocket spirit levels to the delegates, and to the ladies bottles of perfume from their own laboratories.

MUNSELL AND MICA.—The combined exhibit of Eugene Munsell & Company and the Mica Insulator Company occupied space No. 11 with a handsome booth in dark rich blue material paneled in gilt, the central space being occupied by easy chairs and a rug, like a richly furnished parlor. The Mica Insulator Company's exhibit consisted of "Micanite" plate, flexible plate, cloth, paper, M. I. C. compound, "Empire" cloth and paper, "Micanite" tubes and troughs, and various forms of insulation, of which this company make a specialty. Eugene Munsell & Co.'s exhibit consisted of mica in the sheet and a variety of sizes. Both the India and amber qualities were shown, also mica as it comes from the mines and mica segments. Directly over the desk, suspended from the sign, was a large rare specimen of India mica, size 14x36 inches, probably one of the largest sheets ever mined. This is such a rare specimen that there are probably less than 3 or 4 pounds of mica of these dimensions in the United States. The souvenir distributed was a very neat card case, and it was highly appreciated by the delegates in attendance. The exhibit was in charge of Mr. Chas. E. Coleman, western manager, assisted by Mr. Howard M. Frantz.

THE GENERAL ELECTRIC COMPANY had a large space fronting on four aisles, and was in full force with a large delegation from its various offices and factories. The members of its staff who attended were: S. D. Greene, S. Trawick, Geo. Rosenthal, E. D. Mullin, T. P. Bailey, R. D. Beach, F. W. Willcox, F. E. Case, F. H. Strieby, A. H. Armstrong, W. F. Hayes, B. E. Sunny, F. Barbour, W. J. Ferris, E. D. Priest, J. J. Mahoney, F. M. Kimball, R. A. Swain, Geo. J. Cadwell, J. W. Johnson, W. B. Potter, F. N. Boyer, J. G. Barry, J. W. Buell, J. H. Livsey, H. R. Bishop, Jr., Geo. Breed, R. E. Moore, W. G. Carey, T. Ferris and Ward S. Arnold. The exhibit comprised two G. E. 55's mounted on a truck, to be used by the Northwestern Elevated. These motors are 150-hp capacity. In addition, there were two G. E. 100's equipped with the B-13 controller and electric brakes. The motors and brakes were mounted on a St. Louis Car Company's truck. One of the special features of the exhibit was the new G. E. 65 of 250-hp capacity, built expressly for the Paris & Orleans Railway, Paris, France. The exhibit of street car motors comprised a G. E. 52 and a 57. Stationary motors were also shown, the new C. E. type being displayed conspicuously. There was also an air compressor which the General Company are building for elevator work. A line of standard switchboards was on view as the latest type for feeder panel boards; also two standard generator panels and an additional panel on which was mounted a Form G-2 station wattmeter. A large line of supplies of overhead material was also displayed, as well as circuit breakers, lightning arresters, assembled commutators, armature coils and porcelain insulators similar to those used on the third-rail system.

WESTINGHOUSE ELECTRIC & MFG. COMPANY occupied one of the most central spaces, had it decorated with bunting and lamps, and made within it a comprehensive and most interesting exhibit of their apparatus. The display included the following: One 500-kw engine type railway generator, complete; one 200-kw rotary converter, with starting motor; one railway switchboard, complete, for three generators, six feeders, and one load panel; two No. 68 40-hp 500-volt railway motors, mounted in operating order on a Peckham truck; two No. 49 35-hp 500-volt railway motors, mounted in operating order on a McGuire truck; four No. K 10-series multiple controllers; one A 70 115-hp railway motor, complete; one No. 69 30-hp railway motor, complete; one No. 56 55-hp railway motor, complete; one No. 56 railway armature, complete; one No. 68 railway armature, complete; one No. 69 railway armature, complete; one No. 69 railway armature partially wound, with commutation partially connected. The company showed also a complete line of detail apparatus, including fuse boxes, lightning arresters, canopy switches, etc., used in street railway equipment. The 500-kw generator is one of three of equal size which the company has recently sold to the Monongahela Traction Company, of Pittsburg. The switchboard is also to be erected in the power house of the same company. The No. 68 and 69 are the latest type of railway motors built by the Westinghouse Company. An important feature of the new motor is the increased current carrying capacity of the field windings, which allows of an equal temperature rise in both field and armature. Heretofore cases have been noted where the armature was in good condition while the field coils were roasted and ruined, due simply to the fact that the design of the motor was such that the temperature of the field coils rose to a far higher degree than that of the armature. Another feature is in the use of field poles, which are bolted to the yoke instead of being cast in, as has been the practice for the past ten years. The success which these new motors have met with since being placed upon the market has far exceeded the company's greatest expectations. They were built originally on an order from the Third Avenue Railway Company, of New York City, for 500 of the No. 68 motors and 1000 of the No. 69. A further order has recently been received from the Brooklyn Street Railway Company for 900 of the No. 69 motors. The company was represented by the following army: Wm. Bauder, J. M. Duncan, C. S. Cook, F. McCoy, J. H. Reid, C. E. Skinner, N. W. Storer, F. S. Smith, W. M. Probasco, Pittsburg; W. W. Grant, Ottawa, Ont.; J. R. Gordon, E. Woodruff, Atlanta, Ga.; H. C. Marsh, Cincinnati, O; R. S. Brown, Boston, Mass.; C. A. Bragg, Philadelphia, Pa.; A. Hatet, Westinghouse Electric Company of France; C. S. Powell, Cleveland, O.; W. S. Rugg, Irvin Dryer, C. W. Regester, Frederick Nelson, C. G. Burton, W. R. Pinkard, L. M. Harvey, T. A. Hall, T. P. Gaylord, Ivor Hennings, Chicago, Ill.; T. Julian McGill, Minneapolis, Minn.; C. F. Medbury, Detroit, Mich.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was marked by a general recovery in New York and London, due in large measure to the early and emphatic victories of the British over the Boers, promising not only an early renewal of supplies of gold from the Transvaal for the world's needs, but a more open door for civilization, manufactures, etc. Money also eased off temporarily here, although it rose somewhat in Berlin. The end of the week here saw a fine, sharp rally in stocks, with good prospects of continued firmness. During the week 3775 shares of Western Union were sold, closing at 87¾, a rise of ¼; while on just about the same business, General Electric rose to 119⅞, a gain of 1⅜. Brooklyn Rapid Transit was duller and higher, sales of 97,718 shares being accompanied by a rise of 3⅝ to 84⅝. Metropolitan Street Railway rose to 195¼ on 23,395 shares, while on trading in 53,416 shares, Manhattan Elevated went off 1⅜ to 108⅝. In Philadelphia, Electric Storage Battery common closed at 124-126 and preferred 126-128; Union Traction, 39¾; National Electric, 11½; American Railways, 5½; Pennsylvania Manufacturing Company, 27; General Electric Automobile, 6¼; Pennsylvania Electric Vehicle Company, 10½ common and 4¾ preferred. In Chicago, National Carbon common was quoted at 19¼; Union Traction common, 30½; South Side Elevated, 99, and Union Loop, 97½. In Boston, the closing prices for telephone stocks were: American Bell Telephone, 365-366; Erie, 114-115; Mexican, 5⅛; Michigan, 104; New England, 148-155. In the New York outside market Electric Axle was quoted at 5-6; Electric Boat common 22-25, preferred, 37-42; Electric Vehicle common 77-80, preferred, 95-105. The Electric Vehicle Transportation Companies were quoted, New York, 17½-18; New England, 8-8½; Illinois, 3½-4; Otis Elevator, common, 30-33, preferred, 91-93.

KINGS COUNTY ELECTRIC.—It is stated that a special meeting of the stockholders of the Kings County Electric Light & Power Company will be held on Oct. 30. From a semi-official source it is ascertained that the long-talked-of consolidation with the Manhattan Electric Light Companies will be consummated at this time. The second party to the deal is said to be the New York Gas & Electric Light, Heat & Power Company, in which W. C. Whitney and Anthony N. Brady are the controlling interests. This consolidation was all but effected early this year, but a disagreement as to the terms upon which the Kings County Company was to be absorbed has delayed the deal until this time, when a satisfactory arrangement has been made.

ELECTRIC BOAT.—It is reported that the Electric Boat Company has purchased the entire stock and assets of the Electro-Dynamic Company, of Philadelphia and Newark, N. J., with an old and well-established business. At a meeting of the directors of the Electric Boat Company, Mr. Clement A. Griscom, president of the International Navigation Company, and a director of the Pennsylvana Railroad; Mr. William M. Potts, director of the International Navigation Company, and the well-known iron merchant of Philadelphia, and Mr. L. T. Paul, vice-president of the Electro-Dynamic Company, were elected directors of the Electric Boat Company.

DIVIDENDS.—The International Steam Pump Company has declared a quarterly dividend of 1½ per cent. on its preferred stock, payable Nov. 1. Henry R. Worthington Company declared a semi-annual dividend of 3½ per cent. on preferred stock, payable Nov. 1. The Bell Telephone Company of Philadelphia has declared a dividend of 2 per cent., payable Oct. 28.

Commercial Intelligence.

THE STATE OF TRADE continues on the whole excellent. Bradstreet's says: "More nearly, perhaps, than ever before does the volume of general trade and industry tax existing transportation facilities handling the same. From nearly all parts of the country, but particularly from the west and south, come reports of car scarcity. Some of this congestion seems to be the result of a diversion of traffic ordinarily carried on by water routes to already crowded railroads. As an example of this might be instanced the eastbound tonnage movement from Chicago last week, which exceeded by two and a half times that carried in the corresponding week a year ago. The inability of present transportation facilities to cope with the existing situation is, however, not confined to domestic trade lines. From both coasts of this country come reports of insufficient tonnage offering to handle goods seeking a foreign outlet, and freight rates are considerably higher than they were a year or more ago. This latter feature, in fact, is one which may have important effects upon our foreign trade during the balance of the year." Dun's Review says: "In most lines business continues to expand, though in some there are signs that buying has been checked, either because prices have outrun the views of buyers, or because recent purchases have been so heavy that nobody is left in need. Prices are still advancing, in almost every line supported by rising prices of materials, and works everywhere are still crowded to their utmost capacity, while at many points it is found hard to get enough competent hands. But the volume of business expressed in values rises much more than prices, showing a remarkable increase in quantities of goods exchanged. Payments through clearing houses in the past week have been 51.0 per cent. greater than last year and 45.1 per cent. greater than in 1892, and for the month of October thus far payments have been 46.7 per cent. larger than last year and 49.0 per cent. greater than in 1892." A canvass of the electrical and machinery trades supports both cheerful views of the situation. In the metal market, iron and steel continue strong. Heavy steel rails, Eastern mills, are quoted at $35. Copper is weaker, and is quoted in New York at 18 cents.

PLANT FOR MONONGAHELA LIGHT & POWER COMPANY.—Among the immense electrical plants erected by the Westinghouse Electric & Manufacturing Company in all parts of the United States is specially that for the Monongahela Light & Power Company, already noted in this department. Although not as large as the Third Avenue Railroad power station in New York, nor the 50,000-hp plant at Niagara Falls, both of which were installed by the Westinghouse Company, this new undertaking will be the most complete in the Pittsburg district. The month of December should see the plant in full operation, supplying power for the Monongahela Traction Company, with its allied branches, and furnishing light to the towns of Braddock, Homestead, McKeesport, Duquesne and other points in that vicinity. The building for the central power station at Rankin will be 95 feet by 333 feet, with an extension for cold storage to be completed later. The foundations are already finished. The boilers will be of the water tube type, equipped with Roney stokers. The electric generators are being built by the Westinghouse Electric & Manufacturing Company. There will be three 600-kw, 500-volt machines, designed to furnish railroad power; three 750-kw, quarter-phase alternators, and ten 125-light, motor-driven arc light units, with the latest switchboard improvements. Condensers and pumps of the most improved types will be furnished, and coal and ash handling machinery will be installed. The building will be of brick, with steel structural work and truss roof. The cost of the plant will be $500,000, the power and electrical equipment costing $375,000. As soon as the new central station is completed, it will supersede four small plants now in operation, as fully 50 per cent. in expenses can be saved by centralizing. In constructing the foundations, future requirements have been taken into account, and the initial capacity of the plant can be doubled with very slight addition to the buildings.

MARKT & CO. IN EXPORT MACHINERY TRADE.—The well-known firm of Markt & Co., of New York, London, Hamburg and Paris, who for more than a quarter of a century have been large exporters of general hardware, hardware specialties, bicycles, bicycle sundries and small tools, decided some two years since to enter the export ranks with a full line of machine tools. This department was placed in charge of Mr. J. J. Mullaney, who has returned, they inform us, after a seven months' trip through England, Germany, France and Denmark, and reports that business is in a very prosperous condition. Markt & Co. have secured exclusive sale, in most cases for the whole of Europe, of the products of the following manufacturers, whose goods are all well known and appreciated in this country: American Turret Lathe Works Co., Wilmington, Del., who will shortly introduce the Conradson automatic and semi-automatic turret lathes; Grant Machine Tool Works, of Cleveland, Ohio, builders of a general line of machine tools; the Pearson Machine Company, of Chicago, Ill., manufacturers of screw and turret machinery; Lodge & Shipley Machine Tool Company, of Cincinnati, Ohio; Fitchburg Machine Works, of Fitchburg, Mass.; the Bradford Mill Company, of Cincinnati, Ohio; The Oesterlein Machine Company, of Cincinnati, Ohio; Meitz & Weiss, of New York, gas and kerosene engines; Bates Machine Company, of Joliet, Ill. Within the next three months Markt & Co. will open in Europe, in addition to their regularly established offices, three show rooms, devoted exclusively to the exhibition and sale of machine tools, and they have within the last thirty days placed orders for machinery aggregating $60,000 for these machine show rooms. They will also represent at the Paris Exposition the above mentioned manufacturers, who have been allotted over 1100 square feet of floor space.

EXPORTS OF ELECTRICAL MATERIALS FROM NEW YORK.—The following exports of electrical materials are from the port of New York for the week ending Oct. 21: Argentine Republic—28 cases electrical machinery $3207. British Possessions in Africa—12 cases electrical material $227. Brazil—21 packages electrical

material $1915; 35 packages electrical material $6993. British East Indies—2 cases electrical material $92. British West Indies—13 packages electrical material $1006. Bremen—3 cases electrical material $70. Chili—2 packages electrical material $49. Dublin—12 electric cable reels $1900; 2 packages electrical machinery $200. Ecuador—34 packages electrical material $277. Glasgow—23 cases electrical material $315. Hamburg—1 electric vehicle $630; 2 packages electrical material $110; 70 packages electrical machinery $1048. Japan—6 packages electrical material $1321. Liverpool—43 cases electrical material $9757. London—100 packages electrical material $3156. Marseilles—201 cases electrical material $20,020. New Zealand—3 cases electrical material $253. New Castle—3 cases electrical machinery $400. Southampton—3 packages electrical material $76.

THE IRON AND STEEL INDUSTRY.—Mr. Austin, chief of the National Bureau of Statistics, at Washington, states that in his opinion the manufacturers are about the busiest people in the United States at the present time. In the iron and steel industry the figures of our exports show that the extreme activity of manufacturers extends not alone to the home market, but to that supplied by other parts of the world. The exportation of manufactures of iron and steel in the eight months ending with August, 1899, amounted to $68,008,071, against $52,925,082 in the corresponding months of 1898, $40,757,920 in the corresponding months of 1897, and $29,957,090 in the corresponding months of 1896. A still further evidence which our foreign commerce figures show of the activity of our manufacturers is found in the rapid increase in the importation of materials used by manufacturers. The importations of fibres for use in the manufacturing industries in the eight months ending with August, 1899, amounted to $14,377,758, against $11,989,146 in the corresponding months of 1898, and $9,851,516 in the corresponding months of 1897; india rubber, $22,860,318, against $17,418,404 in the eight months of 1898, and $13,100,645 in the corresponding months of 1897, and raw silk for use in manufacturing, $23,452,903, against $16,639,211 in the corresponding months of 1898, and $13,416,156 in the corresponding months of 1897.

THE MANHATTAN BUILDING, located on the corner of Robert and Fifth Streets, St. Paul, Minn., formerly owned by Smith & Taylor, of that city, has been sold to Mr. Charles Lockhart, one of the Standard Oil magnates, of Pittsburg, Pa. This sale includes the Manhattan Light, Heat & Power Company, which was also operated by Smith & Taylor in conjunction with the Manhattan Building. The price paid for the building and the lighting and heating plant was $500,000, and it was practically a cash transaction. The new company have already contracted for additional machinery for the heating and lighting department, having purchased a 250-hp Stirling water tube boiler, and an American Ball engine direct connected to a 75-kw Triumph Electric Company generator. They are also installing a very large marble switchboard, having the very latest appliances, and contemplate extensive improvements and extensions in their underground system. Mr. A. Wilford Zahm, formerly superintendent for the Manhattan Light, Heat & Power Company, has been retained as manager for both the Manhattan Building and the Manhattan Light, Heat & Power Company.

GRAPHITE ELECTRODES.—The Acheson Graphite Company, of Niagara Falls, N. Y., has closed a contract with a European firm to furnish them with 96 tons of graphitized electrodes. The carbon rods for graphitization will be furnished by the National Carbon Company and shipped to the Falls. The work is to be done in the next four months. Europe has never before imported carbon rods in any quantities from the United States, and this is said to be the largest order ever recorded in this field of business. The furnaces of the Carborundum Company will be used to do the work. The process is the discovery of E. G. Acheson, who is president of the Carborundum Company and also of the Acheson Graphite Company. The process has already been noted in our columns and was the subject of an able paper read by Mr. Acheson before the Franklin Institute.

ELECTROLYTIC COPPER.—The Boston News Bureau "understands" that 17 cents is bid for large quantities of electrolytic copper. The explanation of why copper wire which is supposed to be made from Lake Superior copper has sold so closely to the price of lake copper recently will probably be found in the fact that electrolytic is commercially nearer the value of lake than its price indicates. Good copper wire can be drawn from electrolytic copper with a mixture of lake copper. The whole copper and brass business is very rapidly changing. Not only does America need no duty upon copper, but it is actually importing Chili bars and refining them here at a profit, and the brass manufacturers are taking the copper and treating it with new formulas, are exporting it again in the form of brass goods, and underselling the English.

RUBBER.—An officer of the United States Rubber Company says: "There has never been a season when the volume of sales was as large as it has been this year. Jobbers sold up very closely last winter and spring and retail stocks were much depleted. This has created a constant demand for all classes of goods. The reserve held by manufacturers and jobbers is very small. There has been such a demand for goods for immediate delivery as to prevent the ordinary accumulation of supplies. The advance of 5 per cent. announced some time ago has gone into effect in the jobbing trade, and will apply in the retail market Nov. 1."

LARGE PURCHASE OF WILLARD STORAGE BATTERIES.—One of the largest interurban trolley systems now being developed in this country is to cover the region around Anderson, Ind., and will be operated by the Union Traction Company, of Anderson. Current is to be generated on the three-phase plan and distributed to rotaries in connection with which storage batteries will be used. There will be seven substations, for which about 1000-kw of batteries will be required. The order for these batteries has been placed, it is reported, with Sipe & Sigler, of Cleveland. The batteries will be of the Willard type, and have been very favorably reported on by the experts who have tested them.

BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, reports sales for the month of September involving 61 machines ranging in size from 3 to 150-kw. Among the more important were 15 engine type generators for United States Army transports and 10 50-hp motors to operate at 200 r p m for Dick, Kerr & Co., of London, England. Several repeat orders were received, among them being the following: Maryland Steel Company, Baltimore, Md., third order; Consumers' Park Brewery, Brooklyn, N. Y., third order; Atlas Cement Company, Northampton, Pa., fifth order; Missouri Lead & Zinc Company, Joplin, Mo., third order.

EXPORTS FROM BUFFALO.—The Contractors' Plant Manufacturing Company, of Buffalo, is becoming prominent, says Greater Buffalo, in bidding for contracts in foreign countries. It has just secured two large contracts of this nature. One is to furnish all the hand power wrenches for the $10,000,000 New York syndicate which is developing the street railway light and power interests of San Paulo, Brazil, and the second is to furnish machinery for the Cuban Electric Company, a Montreal syndicate, which has secured the ferry rights between Havana, Regla and Guanabacoa, Cuba.

EDISON CEMENT WORKS.—Some details were given in this department a few weeks ago as to the plans maturing rapidly for Mr. T. A. Edison's proposed new cement works. The greater part of the machinery will be of special design. Some of it will be built by Mr. Edison. The engines and boilers have been purchased. Edward P. Allis, of Milwaukee, received the engine contract. There will be three of the vertical compound type, two of 700-hp and one of 500-hp. The order for the boilers has been placed with the Clonbrock Company, of Brooklyn.

THE HAWLEY DOWN-DRAFT FURNACE COMPANY are doing an extensive foreign business. They have recently shipped to London a 500-hp Hawley furnace for use in the Central Market cold storage department, and have also installed four of their furnaces (900-hp) in the Tokio Electric Light Company, Tokio, Japan, which is the second installation there, the first one being six furnaces of 250-hp each. They are also negotiating for an installation in India. Their 300-hp furnace in use in the Paris, France, municipal water works is giving great satisfaction.

DEVELOPMENT OF SAGUENAY RIVER WATER POWER.—Hon. S. W. Parent, of the Quebec local government, has announced that the English & United States Company, which has applied for certain water powers on the upper waters of the Saguenay River, Que., for the purpose of establishing calcium carbide works, will spend over $1,000,000 there if they can obtain the privilege. The government engineer is engaged in preparing a report for the Minister.

AUTOMOBILE PLANT IN BUFFALO.—It is reported that the Woods Vehicle Company will establish a large plant at Buffalo. It is said that the New York Central Railroad has ordered 50 automobiles from the company, and will use them in Buffalo in competition with horse cabs.

ENGINES EXPORTED.—The A. B. Farquhar Company, of York, Pa., last week shipped a 70-hp engine and boiler to Cuba, one carload of plow material to South Africa, and two carloads of engines and saw mills to Georgia.

WIRE EXPORTATIONS.—It is reported from Boston that the American Steel & Wire Company has engaged ocean room to the extent of 3000 tons per month from Boston for the exportation of coiled wire and nails.

THE WESTERN ELECTRIC COMPANY, OF CHICAGO, are reported to have in contemplation the erection of a foundry to make their own malleable castings.

THE HARRISBURG FOUNDRY & MACHINE COMPANY has closed a contract for several engines for the Virginia Coal, Iron & Coke Company.

THE S. MORGAN SMITH COMPANY, of York, Pa., last week made a shipment of water-wheel machinery to California.

Special Correspondence.

New York Notes.

New York, Oct. 23, 1899.

THE GENERAL INCANDESCENT ARC LIGHT COMPANY, 572-578 First Avenue, New York, has absorbed the Wright Discount Meter Company, and all inquiries regarding the Wright system of charging will receive prompt and careful attention.

LECTURES FOR ELECTRICAL WORKERS.—A course of 12 lectures for journeymen electrical workers will be given by Mr. Arthur A. Hamerschlag under the auspices of the New York Trade School, beginning with Oct. 27. The lectures will be held at the New York Trade School, First Avenue, Sixty-seventh and Sixty-eighth streets, and there will be an interval of two weeks between them. The dates and subjects of the lectures are as follows: Oct. 27, volts, amperes and ohms; Nov. 10, how to calculate the sizes of wires for leads, feeders, mains, etc.; Nov. 24, how to lay out a feeder and main system; Dec. 8, testing for grounds, leakage and insulation resistance; Dec. 22, the dynamo; Jan. 5, 1900, the electric motor; Jan. 19, connecting motors and dynamos; Feb. 2, switchboards; Feb. 16, circuit breakers rheostats, volt and ammeters for switchboards; March 2, the three-wire system; March 16, the storage battery; March 23, isolated plants.

INAUGURATING THE ELECTRIC SYSTEM ON THIRD AVENUE.—Early on the morning of Sunday last the Third Avenue Railway Company of this city withdraw from service all of the cable cars on the section of its road from the power station at Sixty-fifth Street to 129th Street for the purpose of making connections with and inaugurating the electric conduit service. This work was of an intricate and delicate character, involved the employment of a great number of men, and put to the test the accuracy and general quality of the work that has been done for the last year. Superintendent Robinson said he hoped to be ready to convert the next section, from Sixty-fifth Street to Sixth Street, next Sunday, but it might take until a week later. Within a week after that he expects to change over the section from Sixth Street to the post office. This will be the most difficult piece of work, and may be delayed longer for lack of special steel work for the curves. Until the whole road is equipped with electricity, passengers will have to change cars at the lower terminal of the electric part of the road. For the present the electric cars to be used will be the regular Third Avenue cable cars refitted. The new cars that are to be put on later will be forty-one feet long and will have cross seats with reversible backs, and windows that let clear down so as to make the cars available for summer and winter.

MR. CHARLES T. HUGHES, manager of the New York office of the General Electric Company, was the recipient of a handsome loving cup on Saturday afternoon, Oct. 21, from all the members of his staff. The occasion of the presentation was the fact that on that day 20 years had elapsed since he first entered the employment of Mr. Thomas A. Edison. Since that time Mr. Hughes has been continuously in the employment of Mr. Edison or his successors, now merged into the General Electric Company. The cup was made of Dorflinger green glass with heavy sterling mountings and the usual three handles. Around the outside of the rim were the inscriptions: "Charles Turner Hughes from his Staff." "Thomas A. Edison, Oct. 21, 1897." "The General Electric Company, Oct. 21, 1899." On the inside of the rim was "Twenty Years of Active Service." Mr. Theodore Beran, manager of the supply department of the New York office, made the presentation speech in Mr. Hughes's office and Mr. Hughes responded for himself and Mrs. Hughes, who was also present. During the afternoon Mr. Hughes received the personal congratulations of Mr. Coffin, president of the General Electric Company; General Griffin, first vice-president of the General Electric Company, and many other members of the company. He also received congratulatory telegrams from members of his own staff in Buffalo, Syracuse and New Haven, who were unable to be present.

ROSSITER, MACGOVERN'S NEW FACTORY.—In accordance with an order of the Supreme Court of New York, Charles E. Dustin as receiver, has sold to Rossiter, MacGovern & Co the factory of the Excelsior Electric Company, including its entire equipment. The Excelsior Company was long and favorably known as manufacturers of a high grade of electrical apparatus, particularly in arc and incandescent dynamos and motors, plating and deposition machines and arc lamps. In reply to a question about their purchase, Mr. MacGovern, of Rossiter, MacGovern & Co., said: "Owing to the growth of our business, we had for some time felt the need of more room and increased facilities and the acquisition of the Excelsior Company's works will place us in possession of ample facilities in every department of our business." It is understood that in addition to the other departments of their business the concern will operate extensive repair shops. It is said that this department of their works will be, unquestionably, the most complete to be found in the country. As, of course, they are really the successors of the Excelsior Company, all repairs and new parts for Excelsior machines will also be furnished by them. In acquiring the Excelsior works, Rossiter, MacGovern & Co. have a model plant in every particular. The structure itself is a three-story brick building, 200 feet in depth by 50 feet wide, covering one entire block, and its equipment is modern and complete. It is well situated and will now be found very accessible by a large number of new patrons of its progressive purchasers.

THE AUTOMOBILE CLUB OF AMERICA, which was organized in this city on Monday of last week, has a list of over 100 applications for membership waiting to be acted upon. The objects of this corporation, according to its constitution, are, the formation of a social organization or club, composed in whole or in part of persons owning self-propelled pleasure vehicles for personal or private use; to afford a means of recording the experiences of members and others using motor vehicles or automobiles; to promote original investigation in the development of motor carriages; to co-operate in securing rational legislation and the formation of proper rules and regulations governing the use of automobiles in city and country, and to protect the interests of owners and users of automobiles against unjust or unreasonable legislation, and to maintain the lawful rights and privileges of owners and users of all self-propelled pleasure vehicles whenever and wherever such rights and privileges are menaced; the encouragement and development in this country of the automobile; to promote and encourage in all ways the construction and maintenance of good roads and the improvement of existing highways, and generally to maintain a social club devoted to automobilism. The membership shall comprise four classes, namely: Honorary members, life members, active members, associate members. The honorary membership shall be limited to 25, and shall include ex-officio the following: The president of the United States, the governor of the state of New York, the mayor of the city of New York, the director of the United States Road Inquiry. The active membership shall be limited to four hundred. The associate membership is granted to those living beyond fifty miles of the city and carries with it all privileges except franchise. This class is unlimited. At the meeting the subject of a club race was discussed. Dr. Zabriskie suggested Ardsley for the objective point of the first one. E. E. Schwarzkopf suggested that a show should be held in February, so that manufacturers could make their arrangements to attend an exhibition in New York without withdrawing from those of Paris and London. All the suggestions were favorably received. Secretary Hedge announced that recognition of the club had been received from the French and English organizations and reciprocal relations established.

New England Notes.

Boston, Mass., Oct. 23, 1899.

MR. H. C. FARNSWORTH, who for a number of years traveled throughout the New England states, selling electrical machinery, is now representing the Sprague Electric Company in that territory, having offices in the Exchange Building, Boston. Mr. Farnsworth's acknowledged ability and aggressiveness will no doubt stand in his favor, as of yore, and his many friends in New England will be glad to find him going over his old territory.

Pennsylvania and Ohio Notes.

Philadelphia, Pa., Oct. 23, 1899.

THE TUCKER MANUFACTURING COMPANY, York, Pa., reports that their business has increased to such an extent that they have been compelled to put in new machinery throughout their factory, and are now prepared to fill orders promptly. They are arranging to increase their capital stock from $5000 to $25,000.

FRANKLIN INSTITUTE.—The announcement and programme of lectures before the Franklin Institute, Philadelphia, for the season 1899-1900 has been published. The papers scheduled to be read before the Electrical Section are as follows: Mr. W. J. Clarke, New York, "Transmitting Pictures by Electricity;" Mr. Charles J. Reed, Philadelphia, Pa., "Electro-Chemical Action;" Mr. J. Appleton, Philadelphia, Pa.; "Recent Developments in the Application of the Storage Battery;" Capt. B. W. Dunn, U. S. A., Frankford Arsenal, Philadelphia, Pa. (subject to be announced); Prof. John Price Jackson, State College, Pa., "Electrical Drills and Cutters in Coal Mining;" Mr. C. H. Bedell, Philadelphia, Pa., "Revolution Indicators and Counters;" Mr. J. Franklin Stevens, Philadelphia, Pa., "Electrical Instruments;" Mr. Louis B. Marks, New York, "Enclosed Arc Lighting;" Mr. F. W. Willcox, Harrison, N. J., "Incandescent Filaments and Lamps;" Mr. W. J. Hammer, New York, "Incandescent Lamps;" Mr. W. E. Harrington, Camden, N. J., "Rail-Bonding;" Mr. Titus Ulke, Washington, D. C., "Electro-Metallurgy;" Mr. George F. Atwood, Newark, N. J., "Mean Effective Pressure Indicators;" Mr. Charles F. Scott, Pittsburg, Pa., "Modern Central Station Practice;" Prof. W. S. Franklin, Bethlehem, Pa., "Some Mechanical Conceptions of Electricity and Magnetism;" Discussion, "Automobiles." Among the topics for discussion before the Mechanical and Engineering Section will be the following: "The Electric Motor in the Workshop," "Automobiles," "Gas, Gasoline and Oil Engines;" "Lighting, Heating and Ventilation of Shops and Factories;" "The Transmission of Power on Shipboard." Lord Kelvin's theory of Electro-Optic Effects will be the subject of a discussion before the Physical and Astronomical Section. The discussion will be opened by Dr. A. E. Kennelly.

Pittsburg, Pa., Oct. 21, 1899.

RETURNING DELEGATES.—Mr. J. W. Reid, general manager of the Miller Electrical Maintenance Company of this city, returned from the convention at Chicago this morning. Other local guests to the gathering of street railway men who have also come back are Mr. B. H. Warren, vice-president of the Westinghouse Electric & Manufacturing Company; Mr. C. S. Cook, Mr. W. M. Probasco, Mr. Frank McCoy and J. McC. Duncan.

THE SIXTH BIENNIAL CONVENTION of the National Brotherhood of Electrical Workers was held in this city during last week. The meeting was held in Knights of Labor Hall and about 50 delegates from all over the country were present. Mr. Morris Mead, the city electrician, addressed them and welcomed the visitors to this city. The officers of the organization are: Mr. Thos. Wheeler, of Cleveland, president; Mr. H. W. Sherman, of Rochester, N. Y., secretary; Mr. P. H. Wissinger, of Baltimore, treasurer; R. P. Gale, of San Francisco, vice-president.

Cincinnati, Ohio, Oct. 21, 1899.

PRESIDENT GEORGE BULLOCK, of the Bullock Electric Company, is expected to return from New York on Monday.

MR. JACOBS, of the Triumph Electric Company, spent a few days of this week in Lexington, Ky., on business for the company. Mr. Jacobs reports orders away ahead of present running capacity.

THE LAWTON-BEATTIE COMPANY lost a municipal contract this week through a slight technicality. The work was for the new plant at Bainbridge, Ohio, amounting to about $2000. Cleveland parties captured the contract.

MR. BAYARD KILGOUR, son of President Kilgour, of the Consolidated lines of Cincinnati, was down for an address before the Chicago convention,

but as he was busy getting married this week he was compelled to forego his convention engagement.

MANAGER McCALLUM, of the Electric Railway Equipment Company, is expected back from the Chicago convention on Monday. This firm is getting in readiness a big shipment of poles to Cuba for the Havana Electric Railway Company. About $50,000 is involved in the contract.

MR. J. M. WILSON, promoter of the Dayton & Xenia electric road, is in Cincinnati and has secured about all the franchises necessary for a new 30-mile interurban line to Coney Island or thereabouts. Mr. Wilson sold his interests in the Dayton & Xenia Company at a handsome figure. The last named company expects to get into operation about Dec. 1. Mr. Wilson is getting matters in shape to let some contracts this fall for the new Cincinnati line, anticipating difficulty in getting material, and realizing the advantage of placing orders as far as possible in advance.

Cleveland, Ohio, Oct. 23.

MR. CHARLES F. BRUSH has become interested in liquid air experiments, and has ordered two outfits for preparing the air, from a German concern. One is for his laboratory in this city, while the other will be given to the University of Michigan, of which Mr. Brush is an alumnus.

COLONEL MYRON T. HERRICK, James Parmelee and Francis J. Wing, prominent Cleveland capitalists, are now in New York making investigations into the Marconi system of wireless telegraphy with a view of forming a company of Cleveland capitalists to control the patents in this country.

THE CLEVELAND CITY RAILWAY COMPANY has announced that the Superior Street and Payne Avenue lines, now operated by cable, are to be changed to electric motive power. For its electric lines the company is purchasing a large number of new cars, and will dispense with trailers.

THE CLEVELAND & CHAGRIN FALLS ELECTRIC RAILWAY COMCOMPANY has been granted an extension in time of one year in which to complete its road. The company secured a franchise about two years ago, but on account of lack of capital was unable to complete the enterprise. Additional backing has now been secured.

THE STANDARD WELDING COMPANY, Cleveland, is greatly increasing its facilities for electrical welding. Several large dynamos have lately been put in place in its new power house and a new 400-kw generator is expected from the General Electric Company in the near future. The company is rapidly developing new lines of manufacture in this field. Lathe chuck rings, heretofore turned out of the solid stock, are now made by this process, as are rings for telegraph posts. A large contract for the latter has recently been received.

TWIST DRILL MANUFACTURERS COMBINE.—A meeting of twist drill manufacturers was held at the Hollenden Hotel, Cleveland, last Friday and Saturday, it is said, for the purpose of forming a combination. The Cleveland Twist Drill Company and the Standard Tool Company of this city, both leaders in the enterprise, were represented. The greatest secrecy was maintained regarding the meeting, every one present declining to give out any information. J. D. Cox, Jr., of the Cleveland Twist Drill Company, went to New York immediately after the meeting on Friday.

THE AMERICAN ILLUMINATED SIGN COMPANY.—According to H. K. Hexter, president and secretary of the American Electrical Company, of this city, his concern, together with the Illuminated Signs Company, the Ohio Illuminated Advertising Company and the Kings Patent Illuminated Bulletin Company, have formed a combination to be known as the American Illuminated Sign Company. The new company is to be incorporated under the laws of South Dakota with $1,000,000 capital, and is to have its headquarters in Cleveland. It is said that an option has been secured on a factory site in this city, and that work on a new factory building will probably commence in the near future. It is understood that George Keerl, of Cleveland, is to be general manager of the new company. Mr. Hexter will also hold an important office.

WESTERN NOTES.

Chicago, Ill., Oct. 21, 1899.

CHICAGO AUTOMOBILES AT THE PARIS EXPOSITION.—Chicago automobile and electric motor manufacturers are planning to make their products the feature of the American transportation exhibit at Paris. George E. Wilkins, of New York, expert adviser of the Transportation Committee of the American Commission, is in the city to confer with the manufacturers. The Siemens-Halske Electric Company expect to put in operation soon a system of slot-machine recharging stations for the use of owners of private automobiles. C. S. Knight, vice-president of the company, says the price will be such that the cost of running a vehicle one mile will not be over one cent.

Minneapolis, Minn., Oct. 19, 1899.

AUSTIN, MINN., has recently contracted for a $20,000 municipal electric lighting plant.

THE MINNEAPOLIS GENERAL ELECTRIC COMPANY has contracted to light the armory and gymnasium building of the University of Minnesota. Twenty-one enclosed alternating current arcs and 200 incandescents are used.

GRAY—WELLES.—Miss Isabelle Welles and William I. Gray, electrical contractor and member of the Minnesota State Board of Electricity, were married at the home of the bride's parents at Plainview, Minn., Oct. 10. Mr. and Mrs. Gray will be at home after Nov. 23, at 95 Spruce Place, Minneapolis.

MUNICIPAL PLANT FOR NEW RICHMOND, WIS.—A special election will be held on Oct. 30 to vote on the question whether or not an application shall be made to the commissioner of public lands of Wisconsin for a loan from the trust funds of the state of $21,400 for the purpose of refunding the present bond of indebtedness of the city and the purchase of the electric light works.

THE MINNEAPOLIS GENERAL ELECTRIC COMPANY expects to have its new storage battery plant in operation this week. The cells are of the well known chloride type and have a capacity of 4000 ampere hours. There are 31 double length plates in each cell. The plant is placed in the basement beneath the general offices and the rotary substation, and is divided so that one-half the batteries carries the peak of the load on one side of a direct current three-wire system. The substation receives a three-phase 3000-volt current from the main power house, which is located at the St. Anthony Falls.

THE APPLE RIVER WATER POWER.—One of the most important transfers of real estate has just been completed by the payment to Christian Burkhardt, of Hudson, Wis., of a balance of $34,700 on the purchase price of $41,000 for a portion of his Apple River water power. Several months ago Burkhardt was offered an option upon the great property by Robert N. King, president of the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, New York City and other large cities. Later this option eventuated in the full purchase of the plant and a payment thereon of $6300, pending the adjustment of records and titles. President King at once resold the plant to the St. Croix Power Company, which is now building the dam and power house and erecting the pole line to St. Paul, Minn., where most of the power will be used by the St. Paul Electric Light & Gas Company in connection with its electric light and power system. About 400-hp will be transmitted at a pressure of 20,000 volts. The distance is 25 miles.

Indianapolis, Ind., Oct. 21, 1899.

MUST FENCE RIGHT OF WAY.—The contract for enclosing the right of way of the Indianapolis & Muncie electric railway has been let to an Anderson fence company. The fencing will cost $10,000. The Indiana statute requires all railway companies to fence their rights of way except in towns and cities.

NEW OFFICERS IN CONTROL.—A change has been made in the officers controlling the Franklin Electric Light & Power Company. The Chicago officers have retired and men of Franklin have succeeded them. The new management promises improved service. F. R. Striekler is president and Victor Smith, secretary and treasurer.

THE AUTOMOBILE is becoming quite common at Indianapolis. In addition to the output of the Indiana factory for home use, H. T. Hearsey & Co. are selling a number of machines daily. Enterprising merchants deliver their goods with automobiles; leading physicians have discarded the horse, and liverymen are keeping them for hire.

TELEPHONE FRANCHISE GRANTED.—The city council, of Rushville, on Oct. 11, rescinded its former action, ordering the New Long Distance Telephone Company from the streets because of its failure to ask for a franchise. The Indianapolis company entered the city over the local Co-operative Company's poles, without consulting the city council. The council and Co-operative Company are not in harmony, and the ordinance was prepared to give the Central Union Company a franchise for an exchange in Rushville.

CONTRACT TO BE LET.—The officers and directors of the Logansport, Pechester & Northern Traction Company, which have secured the right of way to build an electric line from Logansport to Kendallville, held a meeting on Oct. 12. when propositions and bids from several contractors for the construction of the line were opened and considered. President L. C. McNary, without making public the nature of any of the propositions, said that the contract for the construction of the line would be let during the next few weeks.

St. Louis, Mo., Oct. 20, 1899.

BELLEVILLE ELECTRIC LIGHT COMPANY.—A proposition was submitted to the Belleville, Ill., City Council last week by the Electric Light Company to enter into a five-year contract after Oct. 1, 1900, for 170 arc lights at $70 per lamp per annum. The subject was reported to the proper committee and will be acted on at the next meeting.

THE KINLOCH TELEPHONE COMPANY.—A bill granting the Kinloch Telephone Company a franchise for Belleville was reported upon favorably and had its second reading at the Belleville City Council. It will probably be passed at the next meeting. Under the ordinance the company agrees to do certain things usual in such cases. The life of the ordinance is twenty years. Within six months the plant must be in operation and connected with the East St. Louis and St. Louis plants. The rates are fixed at $35 a year for business houses and $20 a year for residences. The maximum charge for a conversation to St. Louis is to be 10 cents.

JUDGMENT FOR MR. BAUMHOFF.—Judge Wood, of the Circuit Court, on Oct. 16 awarded judgment for $5,897.50 to Geo. W. Baumhoff against the St. Louis & Kirkwood Railroad Company for breach of contract. The suit was begun in the St. Louis County Circuit Court, but was transferred to the City Court on a change of venue. The plaintiff claimed $30,000 damages. He alleged that the defendants contracted with him for $250,000 to build ten miles of railroad between Forest Park and Kirkwood, agreeing to provide him rights of way. He was to take half his compensation in bonds of the road. He charged that the defendant failed to keep its part of the contract, and that he was unable to build the road because no right of way was provided.

QUARTERLY REPORT OF RAILWAY COMPANIES.—The reports of all the street railway companies, except the St. Louis Traction Company, formerly the People's, for the three months ending Sept. 30, on number of trips made and passengers carried, are as follows: Cass Avenue and Fair Grounds Railway Company, 133,452 trips, 2,547,474 passengers; Citizens', 79,736 trips, 2,273,256 passengers; Jefferson Avenue, 19,034 trips, 548,305 passengers; Lindell, 291,084 trips, 6,500,410 passengers; Missouri, 88,651 trips, 3,787,997 passengers; St. Louis Railroad, 253,754 trips, 3,287,509 passengers; St. Louis & Suburban, 43,950 trips, 3,243,173 passengers; Union Depot Railway Company, 187,234 trips, 7,046,907 passengers; Southern Electric, 51,154 trips, 1,686,882 passengers. Totals, 1,148,049 trips and 30,921,913 passengers.

San Francisco, Cal., Oct. 15, 1899.

A TELEPHONE EXCHANGE in Lebanon, Ore., is projected.

TO ERECT A NEW STATION.—The Electric Light & Power Company, of Santa Monica, Cal., will spend about $35,000 in the erection of a new electric station.

NO STREET LIGHTS IN THE DALLES.—The Dalles, Ore., has suspended street lighting because the local electric light company would not make a reduction in the rate, which was $11 per arc light per month.

THE NEW PRESIDIO HOSPITAL.—Col. A. C. Girard's plans for additions to the new Presidio General Hospital, San Francisco, have been approved by the War Department. A complete electric lighting system will be installed.

TRANSMISSION PLANT FOR A MINE.—The Baisley-Elkhorn mine will be operated by an electric plant costing about $25,000. At a recent stockholders' meeting it was decided to install a water power electric transmission plant on Pine Creek, near the mine.

THE SKAGWAY TELEGRAPH LINE.—The telegraph rates on the line recently opened between Skagway, Alaska, and Dawson are $3.75 for a ten-word message and 20 cents for each additional word. The way stations are Bennett, Cariboo, White Horse, Tagish, Miles, Canyon, Hootalinqua and Five Finger.

MR. REESE CLARK has made arrangements to apply for a franchise for an electric power system in Yolo County, Cal. He will make application for permission to run an electric car line from Elkhorn to Woodland, thence to Winters and to the terminus at the Seeley mill site, where there is water power available.

NEW POWER PLANT IN SEATTLE.—The purchasers of the Seattle (Wash.) Steam Heat & Power Company will spend over $600,000 in the erection of a new power plant and in the reconstruction of the steam distributing system. Six of the local street railway lines are now owned by these capitalists. The power station is to be completed Jan. 1.

TO ADOPT ELECTRIC TRACTION.—It is reported that the Market Street Railway Company, San Francisco, will soon change over the California street steam line extending from Central Avenue to the Cliff. The new electric line will follow the line of the steam road as far as Thirty-second Avenue, where it will turn towards Point Lobos Avenue and follow that to the present terminus.

CANADIAN NOTES.

Ottawa, Ont., Oct. 21, 1899.

THE IRON MASK GOLD MINING COMPANY, Rossland, B. C., is enlarging its electric hoist and air compressor, and has placed an order with the Royal Electric Company for a 120-kw S. K. C. synchronous motor.

ELECTRICALLY DRIVEN STONE SAW.—P. Lyall & Sons, of Montreal, have installed a large diamond saw, electrically driven, in their stone cutting yard. This saw is a part of the $20,000 electric plant recently purchased by the firm, which includes a traveling derrick and two planers.

MR. EDWARD SLADE, the local electrical engineer and contractor of Quebec, has been named to the position of general manager of the new Jacques Cartier Electric Light & Power Company. Mr. Emerson McMillan, banker, of Wall Street, New York, is the president of the new company.

THE ROYAL ELECTRIC COMPANY, of Montreal, was awarded the contract for installing the new electric light plant to be added to the plant of the corporation of Picton, Ont. The new plant is to consist of one 125-kw S. K. C. two-phase generator with the full complement of transformers, lamps, etc.

MUNICIPAL LIGHT IN LIVERPOOL, N. S.—The town of Liverpool, Nova Scotia, has taken up the municipal electric lighting business and has placed an order with the Royal Electric Company, of Montreal, for a 75-kw two-phase S. K. C. generator, as well as the full complement of transformers and other apparatus. The plant will be in operation on Nov. 1 next.

SEINE RIVER WATER POWER.—Mr. J. J. Durage, of Duluth, Minn., has surveyed the water power of the Seine River, Ont., from Sturgeon Falls to McMannus Falls, a distance of about eight miles. There is a total fall of nearly 100 feet, of which 75 feet are in eight falls. It is feasible to construct power plants for the generation of nearly 3000-hp.

THE DESCHENES ELECTRIC COMPANY, the Hull Electric Company and Messrs. R. and W. Conroy, mill owners, intend to notify the Metropolitan Electric Company, of Ottawa, that the works which are being carried on at Britannia for the purpose of constructing a new channel will divert the waters of the Ottawa from the natural channel and damage the properties owned by the notifying parties. The complainants have their power houses and mills located on the side of the river opposite Britannia, and use the river water for the generating of power. They say the Metropolitan Company's new channel, by taking away part of the water of the river, will probably leave them insufficient force of water with which to conduct their operations.

General News.

THE TELEGRAPH AND TELEPHONE.

ST. PAUL, MINN.—A half dozen local people have incorporated the Cannon Valley Telephone Company, to operate a line between Cannon Falls and neighboring towns.

DENVER, COLO.—Another rival of the Bell Telephone Company has appeared in the incorporation of the Denver Independent Electric Telephone Company, with capital of $500,000.

PANA, ILL.—The Pana Modern Electric Light & Power & Street Railway Company contemplates large telephone extensions and desires to secure catalogues of telephone manufacturers.

FAIRBURY, NEB.—The Fairbury Telephone Company, which was recently organized, expects to have its exchange in operation about Dec. 1 next. The apparatus of the American Electric Telephone Company will be used. The company will have 110 subscribers and the switchboard will have a capacity of 200. The rates will be $1.25 per month for residences and $2 for business houses.

FORMAN, N. D.—The Forman Telephone Company is contemplating building some extensions to its system. It has exchanges at Lisbon, N. D., and Wahpeton, N. D., in both of which the apparatus of the American Electric Telephone Company is used. The company has 200 subscribers and operates 250 miles of toll lines. Its rates are $1.50 per month for residences and $2 for business.

BOSTON, MASS.—It is reported that the Postal Telegraph Company intends to enter actively in the telephone business in direct opposition to the Bell Company. Parties giving out these statements said that independent companies are already operating extensively in St. Louis and other Western cities, and that the Postal will develop this line of business in the east. An officer of the Postal Company in New York stated that there was no foundation for this report.

ROCKFORD, ILL.—What may result in a bitter telephone war here was inaugurated by the introduction in the city council of a petition from the Union Electric Telephone & Telegraph Company asking for a franchise to put in a system, its rates to be $30 a year for business houses, $18 for residences and $12 for party lines, all to be long distance metallic telephones. This is a large cut from the rates of the Bell Company. The new company has secured 800 subscribers, many of them being present users of the Bell telephones. It is proposed to organize a local stock company to build the system.

CHATTANOOGA, TENN.—The Citizens' Telephone Company, of this city, was recently organized by Mr. Pat T. Farnsworth, representing the North Electric Company, of Cleveland. Four or five attempts have been made to establish independent companies, but all had failed. The people, however, wanted the new company. Eight hundred subscribers were guaranteed for the new exchange, 75 per cent. of whom are subscribers to the East Tennessee Telephone Company. The new exchange will be operated on the central-energy system with a switchboard capacity for 3000 subscribers. The first installation will have 1200 drops. The business element of the city is behind the new enterprise.

PROPOSED CONSOLIDATION.—Representatives from the various local telephone companies of Vermont and northwestern New York met in Middlebury, Vt., recently for the purpose of bringing about a consolidation of their interests. The companies represented have about $75,000 interest in local exchanges and toll lines. It is proposed to incorporate the new tri-state company with $150,000 capital, thus allowing $75,000 for the extension of lines, etc. The following companies were represented: Lincoln & Bristol Telephone Company, of Middlebury; People's Telephone Company, of Brandon; Ticonderoga Telephone Company, of Ticonderoga; Rochester Telephone Company, of Rochester; People's Telephone Company, of Warren; People's Telephone Company, of Dresden; Granville Telephone Company, of Granville; Schroon Lake Telephone Company, of Schroon Lake, and Champlain Telephone Company, of Bridport, Vt.

ELECTRIC LIGHT AND POWER.

MINEOLA, TEX.—The electric light plant is unable to run at present for the lack of water.

SPRINGFIELD, ILL.—The Pana Modern Electric Light, Power & Street Railway Company increased its capital from $50,000 to $100,000.

KENOSHA, WIS.—The Kenosha Light & Power Company contemplates the extension of its system in the spring. The company's capital stock is $75,000. Mr. W. H. Schott is president.

MAUMEE, OHIO.—Mr. A. C. Tryon, of Maumee, has received a contract for lighting the village of Maumee with enclosed arcs and will put in a plant at once for arc and incandescent lighting.

SCRANTON, PA.—George W. Conklin has purchased a controlling interest in the Susquehanna Electric Light, Heat & Power Company, and will, it is reported, soon assume the active management of the plant.

GALENA, ILL.—The Galena Electric Light & Power Company has purchased ground, and will soon commence the erection of a large station. When completed the machinery will be moved and new boilers, engines, etc., will be added.

PLATTSBURG, N. Y.—The Plattsburg Light, Heat & Power Company has filed a certificate announcing the increase in its capital stock from $125,000 to $175,000. The company's debts and liabilities are $156,750 in bonds and bills payable. The directors include Albert E. Reynolds and Harry G. Runkle.

ALLIANCE, OHIO.—The Mutual Light Company, which owns the city gas and electric plants here, has sold its property to Chicago capitalists. The final transfer of the concern will be made Dec. 1. The deal was closed in Cleveland by W. W. Cantine, the manager of the Mutual Light Company.

PANA, ILL.—The Pana Modern Electric Light & Power & Street Railway Company, on Oct. 9, elected the following named officers: C. H. Rawlins, president; H. J. Froelich, vice-president; S. K. Gregg, secretary and treasurer and purchasing agent, with F. A. Kuehnel, formerly of the Chicago Edison Company, manager. The company contemplates making large extensions both in lights and telephones and desires catalogues from manufacturers.

AUSTIN, MINN.—The contracts have been let for a new electric light plant to be owned by the city of Austin. W. I. Gray & Co., of Minneapolis were awarded the electric outfit at $12,900. The Twin City Iron Works of Minneapolis have the contract for putting in the power at $4960. The building was let to Austin contractors. The total cost of the plant will be $20,550, and it is to be ready for operation by Jan. 1.

JEFFERSONVILLE, IND.—The uncertainty supposed to attach to the Jeffersonville electric light contract is ended, and it is now positively fixed that the Wayne Construction Company, of Chicago, will erect a plant and have it in operation here by February 1, though it may be completed by January 1, 1900. The contract is for a $40,000 plant and 110 arc lights of 2000-cp, to cost the city, straight, $46.59 cents per year for each light,

and $46 for each additional light. If at any time the city desires to own the plant, the amount paid for services will be applied to the purchase price, but in that event the city will pay the operating expenses. The cost of incandescent lights will be fully regulated by ordinance. Under the present contract, the city pays $90 per year for each light.

THE ELECTRIC RAILWAY.

ANDERSON, IND.—Union Traction Company has begun the erection of a power house to cost $400,000.

PHILADELPHIA, PA.—The Consolidated Traction Company of Pittsburg has declared a regular semi-annual dividend of 3 per cent. on the preferred stock, payable Nov. 15.

BELLOWS FALLS, VT.—The contract for the building of the Bellows Falls and Saxton's River electric railroad has been let to C. W. Blakelee & Son, of New Haven, Conn., and work will be begun at once.

PEN ARGYL, PA.—The State Belt Electric Railway Company has purchased the plant of the Pen Argyl Electric Light Company, which will be used to operate the trolley road from Bangor to Wind Gap, soon to be constructed.

CINCINNATI, OHIO.—The Falls of the Kanawha River are to be utilized to furnish electric power to operate an electric railway for freight and passengers between Colburg and Mt. Carbon, W. Va. It will now develop a small new coal field.

AMHERST, MASS.—The Northampton & Amherst Street Railway Company, through F. S. Coolidge, president, and G. W. Wyman, clerk and treasurer, has filed a certificate that the full capital, $150,000, is subscribed and 50 per cent. paid in.

NEW BEDFORD, MASS.—W. M. Butler, president, G. A. Butman, clerk and treasurer, with a majority of the directors of the New Bedford, Middleboro & Brockton Street Railway, have filed a certificate of the full payment of the capital, $225,000.

EAST LIVERPOOL, O.—Council has granted the East Liverpool Street Railway Company an extension of its franchise for 25 years, including three new extensions, all of which are to be commenced next spring and be completed within one year.

SHARON, PA.—The Valley Street Railway Company, composed principally of Beaver Falls capitalists, has asked right of way from the city council to build an electric street railway between Sharon and Wheatland and over the principal streets of this city. The Sharon & Wheatland Company ask the same right of way.

RICHMOND, VA.—The Richmond Traction Company will, it is understood, propose to the City Council that the franchise of the whole system of the Richmond Railway & Electric Company be sold at auction, and that the various parts of the road shall be turned over to the successful bidder as the old franchises expire.

MILWAUKEE, WIS.—The Milwaukee Street Railway Company has been using cars for the purpose of delivering freight. The company is now equipped with a large number of freight cars, and it is reported that arrangements have been made whereby in the future the company will do an extensive freight business during the night hours.

SAN FRANCISCO, CAL.—The Sutter Street Railroad Company has secured definite control of the Sutro road to the cliff. The 21,300 shares of stock in the road held by the Sutro estate were sold at auction to Robert F. Morrow of the Sutter street railroad system for $215,000. As there are debts of $114,000 the amount which the estate will receive is $101,000.

WHITE PLAINS, N. Y.—Through an order of Judge Marean the Peekskill Traction Company has gone into the hands of Frank Foye, of Peekskill, as receiver. The decree was signed on application of Edwin N. Sanderson and H. Hobart Porter, the contractors who built the Peekskill trolley road. The contractors recently filed a judgment against the company for $182,155.

NEW YORK, N. Y.—The fight between the Union Railway Company and the New York, Westchester & Connecticut Traction Company was brought to a standstill when the authorities of Bronxville obtained from Judge Barnard an injunction restraining both companies from doing any more work until the citizens have a chance to be heard in the courts as to what they wish.

JOPLIN, MO.—At the meeting of the Southwest Missouri Electric Railway Company at Carterville it was definitely decided to make several extensions of the line and to double track the present main line from Cartersville to Lakeside. This double tracking will be done this winter and it is understood it is the intention of the management to have double tracks for its whole line eventually.

BROCKTON, MASS.—The Brockton & Plymouth Street Railway Company has been chartered, among the incorporators being J. P. Morse, H. B. Rogers, E. J. B. Huntoon, H. F. Copeland, O. L. Gurney, Frank Bourne, M. P. Clough, H. L. Higginson, C. E. Cotting and Harry Dutton. It will run through Whitman, Hanson, Pembroke, Halifax, Kingston and Plymouth, a distance of eighteen and a half miles. The capital is $150,000.

SAN ANTONIO, TEX.—The strike of the street car men and electrical workers has been settled at a conference between a committee of the strikers, Mayor Hicks and the officials of the street railway and light companies. The union street car men will receive $1.50 for nine hours' work, 16 2-3c. per hour for overtime before midnight and time and one-half for overtime after midnight. The electricians will receive $3 per day of nine hours.

HOUGHTON, MICH.—The Houghton County Street Railway Company was organized under the Michigan state laws last July. The company has obtained locations in the towns of Houghton and Hancock, and it is the intention to connect these towns with those to the north and northeast. F. J. Bawden is president and E. S. Webster, treasurer. These gentlemen, with W. H. Taylor, C. A. Stone and W. O. Chapman, constitute the board of directors.

UNIONTOWN, PA.—The Uniontown Electric Railway passed into the hands of the combine that controls, or will eventually control, the electric roads of Connellsville, Scottsdale, Mt. Pleasant and Greensburg. The Uniontown road costs the new owners $60,000, they taking up all the stock, amounting to $35,000, and assuming the bonded indebtedness of the company, amounting to $25,000. The object of these purchases is to combine all the electric roads in the coke region and operate them from a central point.

VINELAND, N. J.—The Borough Council will hold a special session to hear the proposition of two rival trolley companies for the use of the streets. The Millville Traction Company wishes to establish, as an outlet for its local road a single track line between Millville and Vineland. The American Railway Union, the big trolley combine, which now operates an electric railway between Bridgeton and Millville, proposes running a line from Bridgeton eastward, taking in the small towns, such as Rosenhayn, Carmel and Norma, to Vineland, and thence southward to Millville, completing a triangular circuit of the three principal towns of the county.

KANAWHA, W. VA.—The Kanawha Traction & Electric Company has secured a perpetual right of way over the county road from Kanawha Falls, in Fayette County, to Coalburg, in Kanawha County, West Va., a distance of eighteen miles, and traversing one of the largest coal producing sections of West Virginia. At present the road will be built from Mt. Carbon to Handley, a distance of seven miles. The survey has been made, the company will be capitalized at $75,000, and $50,000 first mortgage 6 per cent. 20-year gold bonds will be issued with which to equip the road. The company is now having specifications and details of the road made, and will receive bids for the work very shortly. The principal office and power house of the company will be in Montgomery, W. Va., from which point all desired information will be furnished.

THE AUTOMOBILE.

ST. PAUL, MINN.—A stock company has been organized at Webster City, Ia., to build a factory for the manufacture of a new horseless carriage. The capitalization is $150,000. The carriage was invented by the Smisa Bros., expert mechanics. It is said to weigh but 500 pounds, and a speed of from 12 to 24 miles per hour can be made.

THE SCOTT JANNEY ELECTRICAL COMPANY, which recently offered to build and operate the new trolley line on South Carolina Avenue at Atlantic City, N. J., now announces that it will give that city an automobile transportation service, beginning next spring, with a 5-cent fare. Sixty vehicles have been ordered and are to run on Atlantic Avenue as frequently as the trolley cars, while feeder lines will be run on the cross avenues to the beach front. Each coach will carry 22 passengers and will run 7 miles an hour. Automobile delivery wagons are also projected. The Scott Janney Company was recently incorporated in New Jersey, with a capital of $30,000,000, and the stock was offered in Philadelphia.

NEW COMPANIES.

SPRINGFIELD MUTUAL TELEPHONE & TELEGRAPH COMPANY, Springfield, Ill.; capital, $50,000; to operate telephone and telegraph lines. Incorporators, Thomas W. Wilson, S. M. Rogers, J. M. Wilson.

INDEPENDENT CONSTRUCTION COMPANY, Archibald, Pa., to construct and operate telephone exchanges. Capital, $20,000. Incorporators, A. J. Vernier, C. M. McLaughlin, G. H. Rorick, M. Rorick, J. B. Rorick.

NAZARETH & BATH STREET RAILWAY COMPANY, Nazareth, Pa., to construct and maintain a street railway. Capital, $24,000. Incorporators, J. J. McKee, C. A. Wolle, A. Hill, G. H. Wolle, T. M. Dodson, all of Bethlehem.

BUFFALO BATTERY COMPANY, Buffalo, N. Y., to manufacture and deal in electric batteries, etc. Capital, $10,000. Incorporators, W. J. Knowles, Maria Knowles, J. J. Gibson, C. E. Forsyth, F. O'Leary, W. M. Hawkins, all of Buffalo.

THE SOUTHERN HEAT, LIGHT & POWER COMPANY, Pittsburg, Pa.; to supply light, heat and power by electricity. Capital $1000. Incorporators, J. W. Smith, W. J. Horgan, J. Z. Daly, J. F. McCartney, all of Pittsburg; R. W. Gibbs, of Allegheny City.

THE CONTINENTAL AUTOMOBILE COMPANY, capital $8,000,000, was incorporated at Trenton, N. J. The company is empowered to manufacture automobiles. The incorporators are Julius M. Ferguson, Michael B. Caffey and Charles E. Pennoyer, all of New York.

SOUTHEAST TEXAS TELEPHONE COMPANY.—Principal office at Corrigan, Polk County, Texas, has been incorporated with a capital stock of $10,000, to construct and maintain telephone lines between Beaumont and Trinity via Colmesneil and Lufkin to Conroe via Cleveland.

INTERNATIONAL AUTOMOBILE COMPANY, New York City, has been chartered at Charleston, W. Va., to manufacture and sell automobiles. Capital, $500,000. Incorporators, H. A. La Paugh, Rebecca La Paugh, R. H. Hepner, D. B. Luckey, J. Story, all of New York City.

BAY SHORE TELEPHONE COMPANY, of Toms River, N. J.; to construct and operate telegraph and telephone systems. Capital, $1500. Incorporators, Byron E. Eno, Asa Tilton, Washington Worden, Daniel Holmes, Harry W. Eno, George Haring, Duncan W. Blake, Jr., all of Forked River, N. J.

THE COLD SPRING LIGHT, HEAT & POWER COMPANY, of Cold Spring, Putnam County, N. Y., has been incorporated, with a capital of $20,000, to furnish electric light and power to Cold Spring and Nelsonville. The directors are S. L. Barret and A. S. Hughson, of Cold Spring, and J. F. Ferris, of Nelsonville.

LEGAL.

GOLD CAR HEATING COMPANY has issued circulars to the effect that the suit brought against it by the Consolidated Car Heating Company under the McElroy patent, No. 608,211, of Aug. 2, 1898, has been dismissed. The suit was brought against the Palmer & Monson Street Railway Company, which adopted the Gold system of electric car heating, but it was defended by the Gold Company with its own counsel and at its own expense, relieving the purchaser of all burden and responsibility in the matter. The Gold Company, in their notice to the trade, point out that their system is free of any infringement.

PERSONAL.

MR. WALTER B. SNOW, of the B. F. Sturtevant Co., lectured on Oct. 9 to the students in mechanical engineering at the University of Pennsylvania on "Mechanical Draft."

LIEUT. SANEYUKI AKIYAMA, of the Imperial Japanese Navy, was in New York during the yacht races in order to observe the working of the Marconi system. Lieut. Akiyama has made a specialty of electrical matters, and is in the United States in order to take account of current electrical developments.

WARNER—YOUNG.—The marriage took place at The Anchorage, Pine Orchard, Conn., on Oct. 19, of Mr. M. J. Warner to Miss Olive Young, the daughter of Mr. A. M. Young, who is engaged prominently in so many electrical enterprises, and who was president in 1898-9 of the National Electric Light Association. Mr. and Mrs. Warner will be at home at the Dakota, New York City, after Dec. 1.

MR. EDWARD LIND MORSE, the artist, and son of the late Prof. S. F. B. Morse, was married at the Church of the Ascension, New York, on Oct. 16, to Mrs. Clara Croxson Lounsbery. Their residence will be in Washington. Mr. Morse is well known in electrical circles as a contributor to the literature of telegraph history and as an active member of the Historical Committee of the very successful Electrical Exhibition in New York of 1896.

PROF. EZRA L. SCATTERGOOD has accepted the chair of physics and electrical engineering at the Georgia School of Technology, instead of the chair of physics, as stated in a previous note in this column. In that note it was also incorrectly stated that Prof. Scattergood had held a fellowship from Yale University. The fellowship was in electrical engineering from Cornell University, this branch being the one of which Prof. Scattergood has made a specialty.

MR. ROBERT McA. LLOYD, who was recently elected president of the Electric Vehicle Company, has now become president of the Siemens & Halske Electric Company. He is one of the youngest professional men in the electrical field holding such important office. Mr. O. S. Lyford, another rising man, formerly with the Westinghouse Company, has been made vice-president and general manager, with offices in Chicago. Mr. C. S. Knight has resigned. Under the new régime an active, forward policy is promised that will lead to great results. Mr. Lloyd has also recently put through some important deals for the Electric Boat Company, in which he has long been prominent.

Trade and Industrial Notes.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has just issued a circular giving description and prices of its new switch "Eaco."

RAW HIDE GEARS, ETC.—The new 106-page catalogue of the New Process Raw Hide Company, Syracuse, N. Y., gives much information about new process raw hide, noiseless solid raw hide spur, bevel and friction gears, bushings, washers, etc.

TRADE CATALOGUES WANTED.—The Pana Modern Electric Light & Power & Street Railway Company, Pana, Ill., contemplates large extensions in electric light and telephones and desires to secure catalogues of manufacturers of apparatus of both classes.

MAGNOLIA ANTI-FRICTION METAL.—The Q. & C. Company announces that on and after Oct. 16 it will exclusively control the sale of Magnolia Anti-Friction Metal to the railroads, both steam and electric, of the United States, Canada and Mexico.

THE ILLINOIS ELECTRIC COMPANY, Chicago, has just secured the agency for the Peerless transformers, manufactured by the Warren Electric & Specialty Company, Warren, Ohio. It has secured an order for 18 transformers to be shipped to the Wooster Electric Light Company, Wooster, Ohio.

THE MANHATTAN GENERAL CONSTRUCTION COMPANY, Newark, N. J., has just issued bulletin No. 15, which is devoted to a description of the principal features of its direct current enclosed arc lamps. The lamp is illustrated in its details and complete. Copies of the bulletin will be sent on application.

THE SKINNER CHUCK COMPANY, of New Britain, Conn., are distributing blotters containing an illustration of their "New Model" drill chuck. There is a paragraph as to the readiness with which the chuck may be cleaned and the blotter further gives the capacity of various sizes, together with price list and code word of each.

THE TEXAS ARM & PIN COMPANY, of Beaumont, Texas, is manufacturing cross arms, brackets and oak and hardwood pins for electrical use. This concern has a capacity of 10,000 arms per day and is said to be one of the largest of its kind in the South. From the fact that one of its factories is located at Dewey, Texas, the "Dewey" arm gets its name.

THE BROWN & SHARPE MANUFACTURING COMPANY, Providence, R. I., has just issued a new catalogue of machinists' tools and measuring tools, which shows a number of tools of new design, together with new illustrations, showing the older tools to much better advantage. Much time and care have been spent in giving full explanations of the various tools and their particular uses.

SUNBEAM LAMPS.—In a recent bulletin issued by the Western Electric Company a new type of Sunbeam lamp for street railway service is described. The lamp is for use in series of 500, 550 and 600 volt circuits, and in three economies, 3.1, 3.5 and 4 watts per candle. The circular states that each lamp is measured for candle-power while revolving, and all are rejected that do not come up to the standard.

ELECTRIC LOCOMOTIVES.—The Baldwin Locomotive Works, Philadelphia, Pa., have issued a pamphlet containing a record of recent construction. Among the output from their shops were two electric locomotives for the United States government Indian Head proving ground. Both of these, as well as several steam locomotives, are illustrated. The general dimensions of each are given in English and French.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., has the contract for erecting at Yonkers, N. Y., a grand stand for the Empire City Trotting Club. It will be a structure 100 feet wide and 400 feet long, and will be fireproof throughout. The framework will be steel. The roof covering is corrugated iron. This stand will be one of the largest and best equipped structures of its kind ever built.

THE McCAY ENGINEERING COMPANY, Baltimore, Md., is having quite a run on their electrical car form of heaters. This form of radiator is very convenient, as it may be mounted directly on the wall out of the way. These heaters are rated per square foot of heating surface, which rating is based on the standard rating of steam radiators, although the temperature of the electric radiator is much higher. This makes the rating of the electric heaters very conservative. The company's fall business promises to be very large.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED OCT. 17, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

634,220. ELECTRIC SIGNALING APPARATUS FOR ELEVATORS; J. B. Smalley and C. A. Reiners, Chicago, Ill. App. filed Sept. 22, 1898. An incandescent signaling lamp is carried by each car, and a lamp located on each floor. A commutator controlling the passage of current through the lamps comprises a screw-shaft with a carrier nut thereon carrying brushes, the nut being arranged to move in unison with the elevator car. Contact plates are arranged along the path of travel of the brushes, supporting arm. (Issued Oct. 3, 1899.)

634,862. TOOL FOR ELECTRICIANS; J. N. Baggett, Bartow, Fla. App. filed July 19, 1898. The tool is a screwdriver having a hollow handle adapted to contain fuse wires and other small articles used by a wireman. The end of the handle is fitted with a cap in the form of a lamp plug which may be used temporarily to tap a circuit and obtain light while repairs are being made.

634,871. SWITCHING APPARATUS; A. T. Brown, Syracuse, N. Y. App. filed May 11, 1896. The invention consists essentially of a switching apparatus provided with fixed and movable terminals connected to a series of circuits, the fixed terminals being formed with engaging surfaces arranged to entirely or partially surround the movable terminals. The apparatus is used in telephone exchanges and is designed to economize space.

634,911. THERMOSTAT; G. F. Richardson, Hartford, Conn. App. filed May 19, 1899. A bar, sensitive to heat and cold, acts upon a circuit-closing lever; the lever impinges upon one or the other of two contact points and is adjustable by a special contrivance with respect to the points.

634,912. MECHANISM FOR ELECTRICALLY ILLUMINATED DEVICES; J. S. Richardson, S. Jevons and W. A. Gent, Birmingham, England. App. filed Sept. 24, 1898. The lights of advertising signs are controlled by a falling weight which automatically cuts in a solenoid at the end of its travel and the solenoid, in turn, lifts the weight.

634,932. LIGHTNING ARRESTER; H. C. Wirt, Schenectady, N. Y. App. filed July 12, 1899. The invention comprises the connection of a lightning arrester in a non-inductive shunt around the terminals of the translating device to be protected, said shunt having a spark gap or other barrier for the dynamo current, the ground connection being completed at some other point of the circuit.

634,933. ANTISEPTIC AND GERMICIDE ATTACHMENT FOR TELEPHONES; A. E. Woolf, New York, N. Y. App. filed March 16, 1899. (See Current News and Notes.)

634,937. SPEED INDICATOR; H. W. Buck, Schenectady, N. Y. App. filed Aug. 7, 1899. (See Current News and Notes.)

634,940. COMBINATION PUSH BUTTON AND FIRE ALARM; W. A. Guthrie and J. B. Underwood, Durham, N. C. App. filed Jan. 21, 1898. The device, as normally operated, is an ordinary push button, but one of the spring-mounted contacts is held out of engagement with the other by a fusible piece which, under the action of heat, will yield and permit a closure of the circuit to send in a fire alarm.

634,965. ELECTRICAL MEASURING INSTRUMENT; E. Thomson, Swampscott, Mass. App. filed Dec. 31, 1897. (See Current News and Notes.)

634,979. ELECTRIC MOTOR FOR DRIVING MOTOR CARRIAGES,

WINCHES OR STATIONARY MACHINERY; H. W. Headland, London, England. App. filed Jan. 18, 1898. (See Current News and Notes.)

635,004. UTERINE BATTERY; C. H. L. Souder, Chicago, Ill. App. filed Jan. 30, 1899. A vital feature of the invention is a cup of hard rubber, enclosing a battery, with internal and external pole-pieces, the cup adapted to be applied to the part to be treated.

635,006. INSULATED HANDLE FOR ELECTRICAL APPARATUS; J. J. Walsh, Yonkers, N. Y. App. filed March 10, 1899. An insulated hub for the shaft of a rheostat or other electrical apparatus, consisting of two separate parts of insulating material bolted together and keyed to the shaft.

635,007. TELEGRAPH WIRE JOINT; T. D. Wilkinson, Portland, Me. App. filed April 25, 1899. The joint consists of two parallel tubes, the diagonal opposite ends of which are closed and have curved or tapering surfaces, thereby avoiding obstructions which would interfere with drawing the wire along.

635,008. TELEPHONIC APPARATUS; G. E. Anders, London, England. App. filed May 12, 1899. The transmitter and receiver are made to be mechanically attached to and detached from each other. When so attached the signal bell at the home station may be rung from the distant end, and by operating a push button mounted on the combined instruments a signal may be sent to the other end of the line.

634,862.—Tool for Electricians.

635,010. MEANS FOR TESTING SIGNALING CIRCUITS; H. C. Bundy, Watertown, N. Y. App. filed March 16, 1899. The invention applies to fire alarm and similar circuits, and consists in interposing in shunt with a box a resistance of sufficient capacity to prevent a short circuit around the break wheel, whereby on starting the box train current will be shunted through the break wheel to cause the bell to sound, indicating a correct condition, but without affecting the main line.

635,058. ELECTRIC INCANDESCENT LAMP; W. J. Phelps, Elmwood, Ill. App. filed May 23, 1898. An improvement in Westinghouse sockets, whereby the current may be cut off and on by rotating the lamp bulb.

635,080. SYSTEM OF STOPPING STEAM ENGINES; A. J. Perinton and J. R. Reynolds, Hartford, Conn. App. filed July 20, 1899. An electromagnetic vacuum breaker is connected with the condenser of the engine and a circuit extends therefrom to a stop controlling the passage of steam to the engine.

635,130. SWITCH SIGNALING DEVICE; C. Fearson and W. E. Bradley, Philadelphia, Pa. App. filed April 9, 1899. The movement of the switch tongue oscillates a fuse containing a gravity switch and the switch controls a signal circuit.

635,131. ELECTRIC HEATER; E. E. Gold, New York. App. filed Jan. 31, 1898. The support for the resistant coiled helix is an insulated rod wound into a spiral, the helix being interwound therewith and supported between the adjacent convolutions thereof.

635,132. ELECTRIC HEATER; E. E. Gold, New York. App. filed Jan. 31, 1899. A modification of the preceding.

635,133. ELECTRIC HEATER; E. E. Gold, New York. App. filed Jan. 31, 1899. Related to the preceding.

635,139. REGULATING ELECTRIC MOTORS; M. T. A. Kubierschky, Berlin, Germany. App. filed Aug. 4, 1899. (See Current News and Notes.)

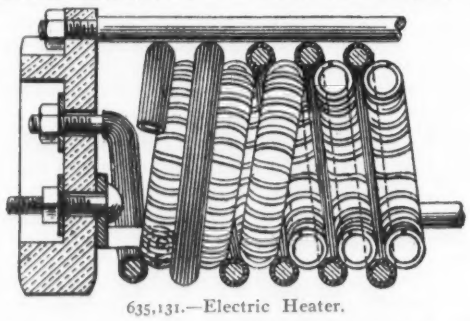
635,159. ELECTRIC METER; Elihu Thomson, Swampscott, Mass. App. filed Sept. 10, 1897. (See Current News and Notes.)

635,172. PUSH BUTTON; A. C. Weier, Sedalia, Mo. App. filed July 7, 1899. A non-conducting base is held in position by a screweye which passes into the wall and constitutes one terminal of the circuit. The button is arranged to push a spring, forming the other terminal, into contact with the head of the screweye.

635,195. TELEPHONE CALL; J. Shannon, Buffalo, N. Y. App. filed Feb. 23, 1899. The ringing up crank engages with a register for registering the number of calls.

635,209. ANTISEPTIC DEVICE FOR SOUND TRANSMITTER MOUTHPIECES; G. W. Van Alstine, Los Angeles, Cal. App. filed April 6, 1899. (See Current News and Notes.)

635,252. ELECTRIC RAILWAY; L. D. Howard, Philadelphia, Pa. App. filed



635,131.—Electric Heater.

Sept. 30, 1891. Contacts at intervals along the rod are arranged in pits which are normally covered by a two-part hood, the members of which are adapted to open and close.

635,262. TROLLEY WHEEL; J. H. and G. H. Lester, New York. App. filed Jan. 31, 1899. Details of the mounting.

635,276. MAGNETO ELECTRIC MACHINE; E. B. Cutten, Butte, Mont. App. filed Aug. 19, 1899. In connection with the armature circuit is a shunt circuit, and a switch is arranged for opening and closing the latter, said switch consisting of a rotating part in the shunt circuit and having interruptions in its conducting contact surface; an interrupter makes contact with the rotating part and is movable to vary the point of contact relatively to the armature poles.

GERMAN PATENTS, ISSUED OCT. 4, 1899.

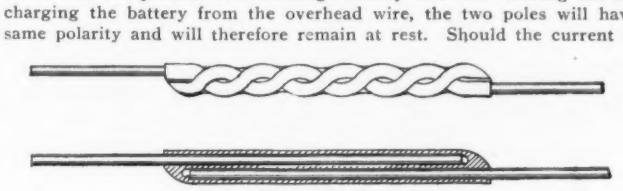
[In Charge of Dr. Ralph Julian Sachers, 120 Liberty Street, New York.]

103,652. SWITCH SYSTEM FOR ELECTRIC RAILROADS; Sacchsische Accumulatoren Werke, Dresden. App. filed July 21, 1898. The axle of the trolley pole is provided with two metallic sectors, opposite to which are two contact pieces. One of the same is in circuit with the storage battery, the other with the incandescent light system of the car. A resistance is placed between one of the contact pieces and the storage battery and a lamp resistance between the other contact piece and the light system. By throwing back the trolley pole, so that one of the sectors may come in contact with either one of the contact pieces, the two resistances can be short-circuited.

104,472. CURRENT CONTROLLER FOR ELECTRIC MOTORS; Westinghouse Electric Company, Limited, London. App. filed May 4, 1897. The controller permits of the following different connections between a pair of motors on the same car and their resistances: A. Connecting in series the two motors and all their resistances. B. Short-circuiting one resistance in each pair of resistances. C. Short-circuiting the second resistance in each pair. D. Connecting up again one of the pairs of resistances. E. Connecting up again of all the resistances. F. After previous disconnection, connecting in parallel the two motors, each having its pair of resistance in series. G. Short-circuiting one resistance in each pair. H. Short-circuiting the remaining resistances. The purpose of the device is to connect the motors independently of each other and symmetrically for any load.

104,559. TROLLEY LINE INSULATORS; Actien Gesellschaft Electricitaets Werke (O. L. Kummer & Co.), Niedersedlitz, near Dresden. App. filed Jan. 26, 1898. The insulator is provided with an arrangement for counterbalancing the strain at curves. It consists of two extensions for fastening the cross-wires at obtuse angles to each other. In one or both extensions are several holes for the cross-wire, one of the same may be selected so as to give a rotation to the insulator which exactly counteracts the strain.

104,591. CURRENT INDICATOR; Union Electricitaets Gesellschaft, Berlin. App. filed June 12, 1898. An electromagnet is provided with a stationary and a movable pole-piece. The magnet has two sets of windings, one in series and one parallel to the storage battery of a car. During the time of charging the battery from the overhead wire, the two poles will have the same polarity and will therefore remain at rest. Should the current be in-



635,007.—Telegraph Wire Joint.

terrupted and the battery be discharged into the circuit, the direction of the current in the main coil will be reversed, different polarity of the adjoining poles will result, the movable pole-piece will be attracted and two contacts will be closed ringing an alarm.

104,299. DEVICE FOR AUTOMATICALLY ADJUSTING THE SLIDING CONTACT OF A WHEATSTONE BRIDGE; Hugh Longbourne Callendar, Montreal. App. filed April 13, 1898. The sliding contact is constantly engaged with two clockworks, tending to move the same in opposite directions. Both clockworks are arrested when the needle of the galvanometer indicates no deviation. But if the needle deviates in one or the other direction, the circuit of one or the other of two relays will be closed, the corresponding clockwork will be released and will tend to move the sliding contact to its zero position.

104,594. PRINTING TELEGRAPH; Leo Kaunn, London. App. filed June 3, 1898. The clutch for the strike rods, arranged on the bar of the printing telegraph, is connected by means of a cord or chain to its controlling electromagnet. This cord runs over a circular segment and a roller, both of which are tangential to the axis of the hollow shaft for the bar. The tension of the cord at all positions of the bar remains therefore the same.

104,596. SHORT-CIRCUITING THE COMMUTATORS OF ALTERNATING MOTORS; Brown, Boveri & Co., Baden. App. filed Nov. 15, 1898. A number of circular rings of spiral springs are located within an insulating cylinder, which is movable in the direction of its axis, within the commutator. By partially pulling out this cylinder at the start, the spirals will get under different sections of the commutator and by pushing in the cylinder at normal run the spirals will be placed between two adjoining sections of the commutator and will short-circuit the same.

104,597. PENDULUM ELECTRIC METER; Josef Moehrle, Munich. App. filed Dec. 13, 1898. Of the excited coils provided on the pendulum, only the central tension coil through which the current passes at all times oscillates within that coil through which the main current to be measured passes. Two other coils oscillate within a second coil in parallel to the main coil. The purpose of this arrangement is to start the meter going even with a very weak current.

104,872. METHOD OF PRODUCING ELECTRIC INCANDESCENT LIGHT; Walter Nernst, Goettingen. App. filed July 6, 1897. Small rods or tubes made of conductors of the second class are used for producing the light. The material employed is a bad conductor at normal temperatures, but becomes a good conductor at high temperatures. The passage of the current is initiated by preliminary heating the body throughout its total length, by means of a separate heating device. Thereafter the current keeps the body incandescent.